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Notes on *Hibbertia* (Dilleniaceae) 5. *H. melhanioides* and *H. tomentosa* groups from tropical Australia

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Abstract

A detailed taxonomic revision of *Hibbertia* §*Tomentosae* Benth. (*Hibbertia* subgen. *Hemistemma* (Thouars) J.W.Horn), was prepared on the basis of a morphological evaluation, including a detailed assessment of the highly diversified vestiture. Nine different types, varying from simple to complex fascicled hairs and/or peltate scales, were distinguished and the description of each species includes full details of the variation encountered on the stem, ad- and abaxial leaf surfaces, bracts, as well as the outer and inner calyx lobes. It thus records differences between the vestiture on these organs of the same taxon.

Fifty-two species and many infraspecific taxa are described (52 as new), keyed out and placed into two groups (*H. melhanioides* and *H. tomentosa* groups) and nine subgroups based on an assessment of the gross morphology and vestiture. All the species have been illustrated.

The following taxa are recognised (newly described ones and new combinations are in bold): ***H. alopecota***, ***H. angulata***, ***H. araneolifera***, ***H. argyrochiton***, ***H. auriculiflora*** subsp. ***auriculiflora***, subsp. ***minor***, ***H. axillaris***, ***H. brennanii***, ***H. brevipedunculata***, ***H. bicarpellata***, ***H. cactifolia***, ***H. caudice***, ***H. ciliolata***, ***H. circularis***, *H. cistifolia* R.Br. ex DC., ***H. complanata*** subsp. *complanata*, subsp. ***ampliata***, *H. cymosa* S.T.Reynolds, *H. echiifolia* R.Br. ex Benth., subsp. *echiifolia*, subsp. ***cernua***, subsp. ***macrantha***, subsp. ***oligantha***, subsp. ***rotata***, ***H. eciliata***, ***H. extrorsa***, ***H. fractiflexa***, subsp. *fractiflexa*, subsp. ***brachyblastis***, subsp. ***filicaulis***, subsp. ***serotina***, ***H. guttata***, ***H. heterotricha***, ***H. incompta***, ***H. incurvata***, *H. lepidota* R.Br. ex DC., ***H. ligulata***, ***H. malacophylla***, ***H. malleolacea***, ***H. marrawalina***, *H. melhanioides* F.Muell., ***H. mollis***, *H. mulligana* S.T.Reynolds, *H. oblongata* R.Br. ex DC., subsp. *oblongata*, subsp. ***brevifolia*** (F.Muell.), subsp. ***macrophylla***, subsp. ***megalanthera***, ***H. oligocarpa***, ***H. orbicularis***, ***H. orientalis***, ***H. pancerea***, *H. pholidota* S.T.Reynolds, ***H. pilulis***, ***H. rufociliata***, *H. scabra* R.Br. ex Benth., ***H. scabrifolia***, ***H. scopata***, ***H. solanifolia***, ***H. stelligera*** (C.T.White), *H. stirlingii* C.T.White; ***H. suffrutescens***, ***H. sulcata***, *H. tomentosa* R.Br. ex DC., ***H. tricornis***, ***H. tridentata***, *H. velutina* R.Br. ex Benth.

Keywords: Dilleniaceae, *Hibbertia*, nomenclature, revision, taxonomy, tropical Australia.

Introduction

> Our doubts are traitors,
> And make us lose the good we oft might win,
> By fearing to attempt.
>
> *Shakespeare, Measure for Measure 1, 5.*

Brief reviews of the taxonomic history of some groups of *Hibbertia* Andrews species were published in Toelken (1998, 2000). The following discussion shows similar trends.

Four of the species referred to here were first described by Candolle (1817). He included them in an informal group together with *H. pedunculata* R.Br. ex DC., *H. serpyllifolia* R.Br. ex DC. and *H. aspera* DC., for which he had already expressed concern that it should rather have been placed in the genus *Pleurandra* Labill. Bentham reduced this genus to a section of *Hibbertia* and included the last species in this sect. *Pleurandra*, which was placed next to sect. *Hibbertia* (as '*Euhibbertia*'). Eight groups were described by Bentham within sect. *Hibbertia*; the first two of these are *Hibbertia* §*Tomentosae* and §*Vestitae*. Bentham (1863) placed *H. pedunculata* and *H. serpyllifolia* in *Hibbertia* §*Vestitae*. *H. hermanniifolia* DC. is here excluded from the §*Tomentosae* in agreement with findings by Horn (2005) and will be published separately (Toelken, in prep.). Although the present revision supports similar affinities, it also establishes that *Hibbertia* §*Tomentosae*, as defined here, is distinct, mainly because of its unique vestiture (rosette-like fascicled hairs/scales), toothed/lobed juvenile leaves and usually two basal ovules in each ovary.

Bentham (1863) does not clearly state the rank of *Hibbertia* §*Tomentosae* or seven similar groupings under section *Hibbertia*, but, in contrast to other generic treatments (e.g. *Hibiscus* and *Abutilon*, Malvaceae), he does supply plural adjectival names. It is therefore tempting to infer from his introduction (Bentham 1863,

Table 1. List of taxa and informal groups within ***Hibbertia* §*Tomentosae*** Benth.

1. *Hibbertia melhanioides* group

1.1. *H. melhanioides* subgroup
1. *H. bicarpellata* Toelken
2. *H. melhanioides* F.Muell.
3. *H. heterotricha* Toelken
4. *H. malacophylla* Toelken
5. *H. velutina* R.Br. ex Benth.
6. *H. mulligana* S.T.Reynolds
7. *H. araneolifera* Toelken
8. *H. eciliata* Toelken

1.2. *H. scabra* subgroup
9. *H. cistifolia* R.Br. ex DC.
10. *H. incompta* Toelken
11. *H. scabra* R.Br. ex Benth.

1.3. *H. echiifolia* subgroup
12. *H. guttata* Toelken
13. *H. echiifolia* R.Br. ex Benth.
subsp. *echiifolia*
subsp. *cernua* Toelken
subsp. *macrantha* Toelken
subsp. *oligantha* Toelken
subsp. *rotata* Toelken

2. *Hibbertia tomentosa* group

2.1. *H. tomentosa* subgroup
14. *H. tomentosa* R.Br. ex DC.
15. *H. angulata* Toelken
16. *H. ligulata* Toelken

2.2. *H. orbicularis* subgroup
17. *H. cactifolia* Toelken
18. *H. scopata* Toelken
19. *H. orbicularis* Toelken

2.3. *H. alopecota* subgroup
20. *H. alopecota* Toelken
21. *H. tridentata* Toelken
22. *H. solanifolia* Toelken
23. *H. circularis* Toelken
24. *H. tricornis* Toelken
25. *H. mollis* Toelken

2.4. *H. oblongata* subgroup
26. *H. brevipedunculata* Toelken
27. *H. oblongata* R.Br. ex DC.
subsp. *oblongata*
subsp. *brevifolia* (Benth.) Toelken
subsp. *macrophylla* Toelken
subsp. *megalanthera* Toelken
28. *H. orientalis* Toelken
29. *H. suffrutescens* Toelken
30. *H. axillaris* Toelken
31. *H. caudice* Toelken
32. *H. rufociliata* Toelken
33. *H. cymosa* S.T.Reynolds
34. *H. complanata* Toelken
subsp. *complanata*
subsp. *ampliata* Toelken
35. *H. fractiflexa* Toelken
subsp. *fractiflexa*
subsp. *serotina* Toelken
subsp. *brachyblastis* Toelken
subsp. *filicaulis* Toelken

2.5. *H. stirlingii* subgroup
36. *H. oligocarpa* Toelken
37. *H. extrorsa* Toelken
38. *H. scabrifolia* Toelken
39. *H. stelligera* (C.T.White) Toelken
40. *H. stirlingii* C.T.White
41. *H. pilulis* Toelken
42. *H. malleolacea* Toelken

2.6. *H. lepidota* subgroup
43. *H. auriculiflora* Toelken
subsp. *auriculiflora*
subsp. *minor* Toelken
44. *H. ciliolata* Toelken
45. *H. lepidota* R.Br. ex DC.
46. *H. marrawalina* Toelken
47. *H. sulcata* Toelken
48. *H. pholidota* S.T.Reynolds
49. *H. brennanii* Toelken
50. *H. argyrochiton* Toelken
51. *H. incurvata* Toelken
52. *H. pancerea* Toelken

pp. xxiv, 182) that they are supposed to be subsections, as the only infrageneric taxa he lists are sections and subsections. However, in the same volume Bentham (1863, p. 308–310) uses the rank of series in *Boronia* (Rutaceae). The uncertain use of infrageneric taxa at the time is well shown by the extreme variation in interpretation, rank and names within *Acacia* provided by Bentham (1864) and subsequent publications as compiled by Maslin (2001). All these eight names within *Hibbertia* are here accepted as "validly published but without rank" (McNeill et al. 2006, A. 35.4). The name *Hibbertia* §*Tomentosae*, although used as a grouping, is not given formal rank here. So as not to pre-empt results from a final revision of the genus and more complete evidence from a wider range of DNA-analyses, other groupings are also not given formal ranking. Horn (2005) includes only five species of the §*Tomentosae* in his phylogenetic tree of the genus. They do not assist with the supraspecific arrangement adopted here (Table 1).

At species level taxonomic progress is much slower, as Bentham adds only two species to make it eight species in his §*Tomentosae*. Two new species are described by White (1936, 1942) during the following hundred years, showing a similar slow increase as reported for other *Hibbertia* groups (Toelken 1998, 2000). Craven (1996) remarks on the drastic increase in the number of *Heliotropium* species as a result of more intensive exploration, particularly of the tropical parts of Australia in the second half of the 20th century. An awareness of additional species of *Hibbertia* in the Northern Territory develops: 12 unnamed species are listed by Lazarides et al. (1988), Brennan (1996) increases them to 15, and in 2003 a checklist is placed on the Northern Territory website, which includes 25 phrase names for new species of the §*Tomentosae* alone. This is largely a reflection of the detailed exploration of the Arnhem Land Plateau, while other areas of northern Australia then follow. Reynolds (1991) describes three new species from northern Queensland.

Bentham (1863) recognises 87 species now accepted as Australian hibbertias. Stebbins & Hoogland (1976) estimate their number to be 130, but this has since been steadily increasing. Horn (2007), in his review of the family, provides an estimate of 225 species for *Hibbertia*, being the only genus in the subfamily Hibbertioideae. He also proposes four subgenera mainly based on floral development and DNA-analyses (Horn 2009), and places the §*Tomentosae* in *Hibbertia* subgen. *Hemistemma* (Thouars) J.W.Horn.

Thirteen species of 52 recognised in this revision of the §*Tomentosae*, were previously published. *Hibbertia* §*Tomentosae* is here split into two groups, *H. melhanioides* and *H. tomentosa* groups, which in turn

are subdivided into three and six groups, respectively (Tab. 1). Nine species (six endemic) occur in Western Australia; 16 species (13 endemic) are recorded from northern Queensland, and 33 species (29 endemic) are known mainly from Arnhem Land in the Northern Territory. The latter centre of diversity was previously reported in taxonomic revisions of genera in several families as has been aptly reviewed with possible explanations as observed in *Boronia* by Duretto & Ladiges (1997). The importance of this "hot spot" was assessed by Crisp et al. (2001), but a more detailed examination by Woinarsky et al. (2006, t. 3), lacks, in the case of *Hibbertia,* the updated numbers of a revision. The percentage of endemic species in the Northern Territory is therefore very much higher, although only the species of §*Tomentosae* are revised here. They too show some of the more interesting trends:

- The majority of endemic species are found on or in association with the western escarpment of the Arnhem Land Plateau.
- There are species with larger distributions covering the plains, e.g. *H. cistifolia*, or the lower slopes of the escarpment and outlying rock outcrops, e.g. *H. fractiflexa*, which is divided into four isolated subspecies.
- Extremely localised species determined by ecological microhabitats on the sandstone plateau, e.g. *H. incurvata*, which occurs on rock platforms.
- Very few species, e.g. *H. angulata*, *H. ligulata* and *H. scabra* occur on sand along the coast.

This revision is predominantly based on herbarium material but a short expedition to Kakadu National Park provided a good insight into problems of different habitats, growth habits and the difficulty of collecting the wide range of variation needed for a clear delineation of taxa in remote areas, where plants are inaccessible due to widespread flooding for much of the year and/or the rugged sandstone cliffs of the escarpment of the Arnhem Plateau.

The scope of the present revision is largely determined by the amount of material available of species from remote areas. However, disjunct distribution patterns of taxa mainly along the rugged western escarpment of the Arnhem Land Plateau, for instance, are not necessarily due to insufficient collecting in an inaccessible terrain. It would also seem attributable to a dissected topography providing disjunct niches and habitats. It is expected that the complete distribution of some of the variants and taxa will need further refinement as, at present, many of them are known from very few collections.

It is hoped that the present publication will stimulate more exploration and specialised observations particularly of plants in less accessible areas of Arnhem Land, parts of the Kimberley Region of Western Australia and northern Queensland. It is important that collectors obtain:

- a fuller range of variation of all characters of the species but particularly of the vestiture, which might here have played an overrated role in the delineation of some species, while the range in other species, e.g. *H. brevipedunculata*, seems, in comparison, incredibly wide with some local forms quite obvious but without clearly definable characters.
- a wider range of juvenile leaves or preferably seedlings at varying ages of as many species as possible, as they may contribute to a better understanding of the groupings among the species.
- more observations about the pollination biology for which there is at present only the perplexingly different spatial arrangements of the anthers, styles and stigmas not known in any other group within the genus. Bernhardt (1984, 1986) referred mainly to species from southern parts of Australia. More observations will hopefully also lead to a better understanding of the function of staminodes and their inexplicable variability in number. Staminodes have been ignored or overlooked previously in this group of species, possibly because they are small and resemble filaments.

Characters

Vestiture

The indumentum or vestiture, as previously used in Toelken (1998, 2000), shows in the §*Tomentosae* the largest range of variation within the genus *Hibbertia,* varying from simple to fascicled hairs and peltate scales, and, at the same time, usually differing on various parts of the same plant. This provides a suite of additional characters for the delimitation of taxa and some of the vestiture characters have become of pivotal importance at all taxonomic levels, particularly because they are found, in contrast to the gross morphology, to be scarcely affected by environmental conditions. This is especially valued in taxa for which there are at present only a few collections available, usually because of insufficient collecting in much of tropical Australia. Throughout this paper an effort is made to balance the use of gross morphology with that of the vestiture, or at times the two are juxtaposed in order to crosscheck and/or demonstrate decisions taken in the one and compared with the other.

It is very important that the vestiture on the same organ is compared, as each species has a whole range of different hair and/or scale types on different parts of the same plant, with the most advanced on the flower and, in particular, on the ovary. All the species have ciliate to entire scales on their ovary. The vestiture descriptions are here devised and adhered to for maximum information (variation and sequences of developments) at a minimum of sites used: branches, leaves above, leaves below, bract, outer and inner calyx lobes.

The documentation of the vestiture is presented in two ways in each species description as it was done in previous revisions of groups of *Hibbertia* (Toelken 1998, 2000). Firstly, the hair or scale types and their relation to

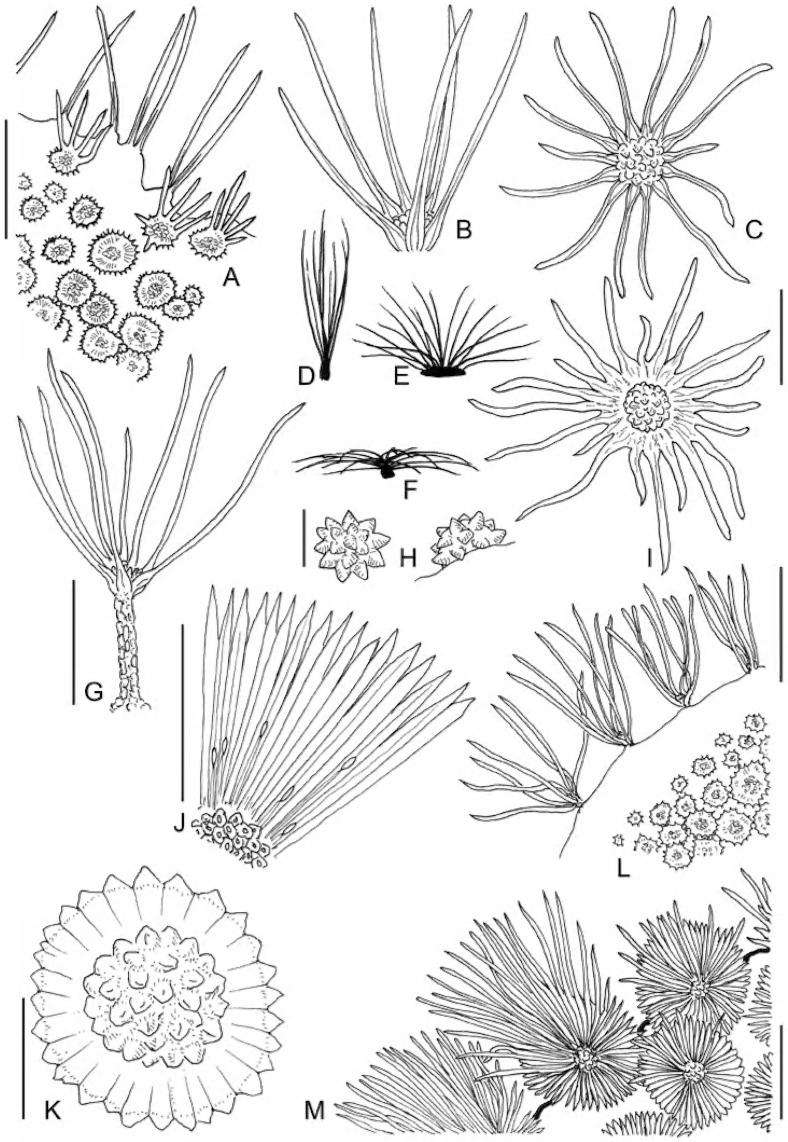


Fig. 1. Hair types. **A** *H. caudice*: **simple hairs** derived from unilaterally enlarged cilia on the margin with some unilaterally enlarged cells along the margin; **B**, **C** *H. orbicularis*: **B** diagram of **rosette-like fascicled hairs** showing broadened bases of all cells but with reduced arms of central ones and unequally long peripheral arms; **C** in surface view and showing unequally long arms; **D**, **E** *H. angulata*: **D rosette-like fascicled hairs** with erect arms; **E** with spreading arms and broad base; **F** *H. oblongata* subsp. *oblongata*: **rosette-like fascicled hairs** with reflexed and/or appressed arms; **G** *H. alopecota*: **stalked rosette-like fascicled hairs**; **H** *H. heterotricha*: **cactiform fascicled hair** in surface view and in side view; **I** *H. auriculiflora* subsp. *auriculiflora*: **ciliate-peltate scales** with arms scarcely basally connate; **J** *H. pancerea*: section of **broad-rimmed peltate scale** showing thick-walled cells; **K** *H. stirlingii*: **narrow-rimmed peltate scale** is often scarcely dorsiventrally flattened; **L** *H. echiifolia* subsp. *macrantha*: **stellate cilia** with few to many branches and vestigial branches often absent; **M** *H. argyrochiton*: **unilaterally enlarged cilia** with arms ± connate to form rays, but becoming lacerated with age, the typical scale-like unilaterally enlarged cilia of species in the *H. lepidota* subgroup. Scale bars: **A** 200 µm; **B**, **C**, **I**, **G** 180 µm; **H** 25 µm; **J**, **L** 100 µm; **K**, **M** 50 µm. — **A** *P.I.Foster 6102*; **B** *G.M.Wightman 1362 & L.A.Craven*; **C, D** *P.I.Foster 6058*; **E** *R.L.Specht 640*; **F** *K.G.Brennan 721*; **G, H** *L.J.Webb & J.G.Tracey 11985*; **I** *J.Russell-Smith 2190*; **J** *K.G.Brennan 3821*; **K** *P.I.Foster 18400*; **L** *P.Martenzs & R.Schodde AE 574*; **M** *L.A.Craven 6594*.

one another are described under vestiture, and, secondly, the type of tomentum is provided for each organ as part of the morphological description.

Types of hair

The following categories of hairs on adult plants were drawn up for the convenience of quick reference and descriptive images of different shapes (Fig. 1 & 2) to distinguish them, but are equally necessary to be able to describe/refer to a range of different hair types or intermediates between extremes, as different types are often found on the same organ. Convenience and specific developments in *Hibbertia*, however, largely thwarted attempts to conform with terminology of widely used systems, e.g. Theobald et al. (1979), Hewson (1988), or detailed evaluations in the Fagaceae (Jones 1986) or Solanaceae, such as Seithe (1962, 1979), Roe (1971) and Bean (2004). The terminology of hairs adopted is here used specifically for the taxonomy of the §*Tomentosae*, which shows the most extreme developments in Hibbertia. As most of these trichomes are specific to species of this group, abbreviations for just this publication do not seem justified.

Hairs in *Hibbertia* usually have thickened walls but in the case of the scales extra layers are deposited. The lumen is usually a very narrow channel through much of each cell (Fig. 1J). The walls do not stain with commonly used plant stains presumably because they are heavily impregnated with silica (Steppuhn 1895, Horn 2007).

The hairs are usually white except for the marginal cilia of the calyx of *H. rufociliata*, *H. echiifolia* and *H. guttata* where the lumen of the cells is filled with a dark brown amorphous substance presumed to be tannins. Few such hairs are also found in the axils of the leaves in the latter two species.

A. Unicellular hairs.

1. **Simple hairs**, e.g. marginal cilia on calyx lobes usually represent extreme reductions of stellate cilia (Fig. 2E) or unilaterally enlarged cilia (Fig. 1A) as described below (cf. hair type 8 & 9).

   A similar extreme reduction is occasionally observed on unilaterally enlarged cilia with only one arm found on vein-ends on leaves of taxa in the *H. oblongata* subgroup (cf. variation of *H. fractiflexa* subsp. *filicaulis*).

   The coarse simple hairs usually found in tufts in leaf axils of the *H. echiifolia* subgroup are also thought to be modified fascicled hairs, but their development has not been studied.

B. Multicellular hairs in *Hibbertia* are fascicled hairs in which the vesicular bases are connate while the distal ends are free and spreading.

2. **Rosette-like fascicled hairs** are similar to multiangulate stellate hairs (Hewson 1988; multangulate: Roe 1971; multiradiate: Jones 1986). They are not stellate hairs but fascicled hairs (Horn 2007) composed of simple unbranched hairs, but here a few to many central arms are reduced to vestigial teeth (Figs. 1B & 2A). The outer whorl of arms may vary in length (Fig. 2B), texture and habit (cf. *arms of hairs* and Figs. 1B–D). Most of the hairs and scales, except simple hairs as described above (cf. 1), in the §*Tomentosae* show this unique characteristic of degenerate central arms. In some species the basal stalk (tubercle) is narrow (thin-based) and with few central teeth, e.g. in *H. tomentosa*, while in others it is broader (broad-based) and often with more than 10 teeth, e.g. in *H. cistifolia* and *H. oblongata*.
3. **Stalked rosette-like fascicled hairs** develop a distinct (multiseriate) stalk below a multiangulate rosette-like apex (Fig. 1G) in forms of the *H. alopecota* complex. It could, however, not be taxonomically used as in the *H. hermanniifolia* group, because of the extremely variable length of the stalk which is often insufficiently well developed in other forms of *H. alopecota* to be recognised.
4. **Cactiform fascicled hairs** are broad- or narrow-based and with rounded apex (Figs. 1H & 2A). They have all arms reduced to teeth (papillae) covering the head, so that the resulting unusual type of tomentum is referred to as "stubble-like".

C. Scales with a dorsiventrally compressed rim formed by the more or less fused arms (usually visible as centrifugal ridges) peripheral to the distal part of the tubercle, which is usually outlined by the central area of the vestigial arms (teeth).

5. **Ciliate-peltate scales** (Figs. 1I & 2D) are usually broad-based and resemble reflexed rosette-like fascicled hairs, but the bases of their arms are laterally more or less connate. Occasionally reference is made to ciliolate-peltate scales in this paper, but these references usually have to be included into the range of variation of entire scales, which are often minutely ciliolate or uneven in outline.
6. **Narrow-rimmed peltate scales** (Figs. 1K & 2C) seem to have developed largely from cactiform fascicled hairs and are at times not easily distinguished from them, except that they are flat-topped, as, for instance, in *H. echiifolia*, *H. fractiflexa* or *H. stirlingii*. Their rim is usually up to 1.5 times the diameter of the basal stalk (= to diameter of the area with vestigial branches). The narrow-rimmed scales are often mixed with and/or merge into cactiform fascicled hairs (with rounded apex) and thus appear to be mainly derived from them.
7. **Broad-rimmed peltate scales**, (Fig. 1J) or common peltate scales are like the ciliate-peltate scales, but with arms more or less connate. They have a rim more than twice as broad as the diameter of the basal tubercle (= diameter of the area with vestigial arms) and they are usually membranous although faint ridges still show the outline of the

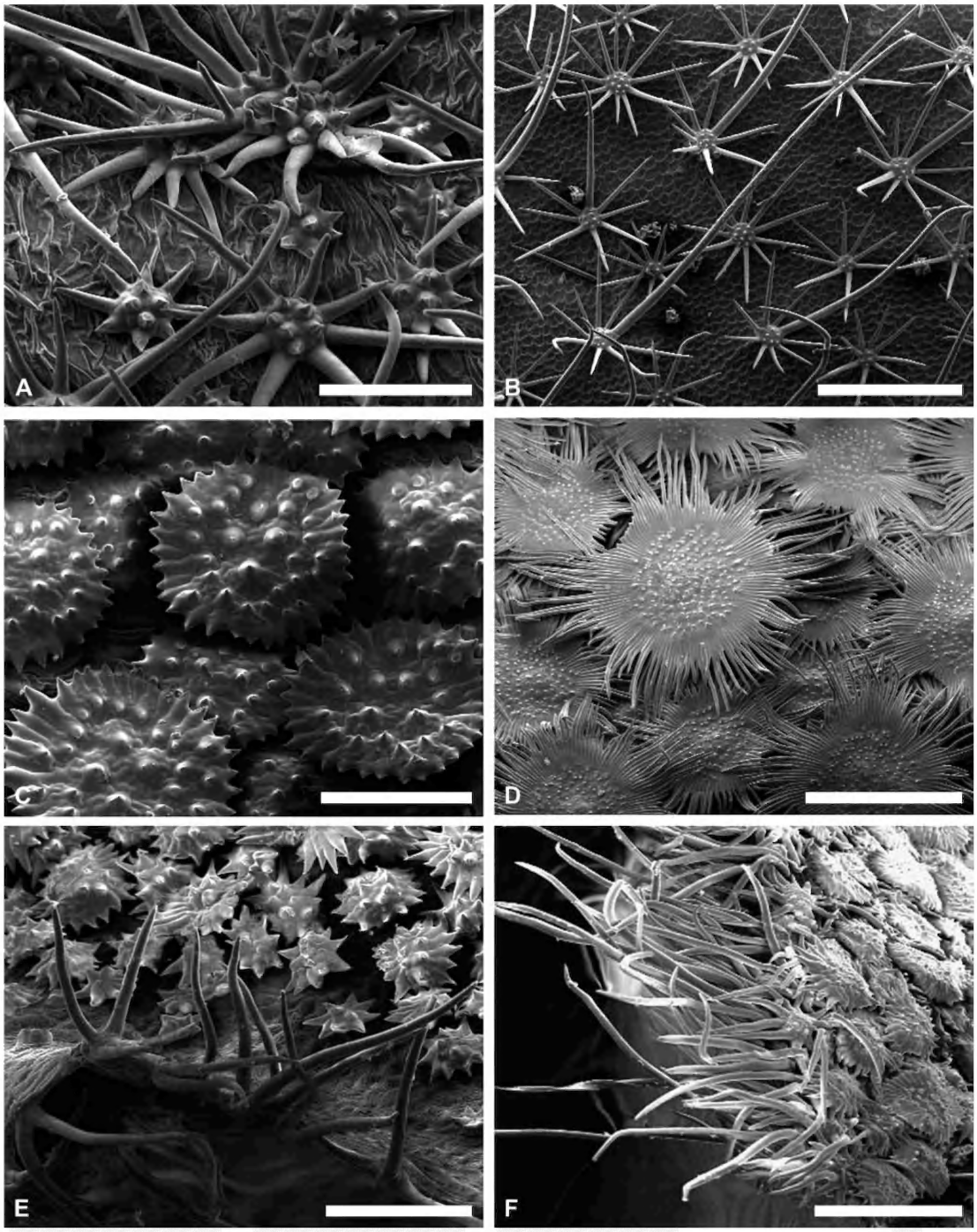


Fig. 2. Hair types. **A** *H. heterotricha*: **rosette-like fascicled hairs** with spreading arms overtopping **cactiform fascicled hairs**; **B** *H. tridentata*: upper leaf surface with **rosette-like fascicled hairs** with one extremely long arm; **C** *H. fractiflexa* subsp. *brachyblastis*: **narrow-rimmed scales**; **D** *H. pancerea*: **ciliate-peltate scales** in several layers; **E** *H. cistifolia*: **stellate cilia** on the margin next to narrow-rimmed scales and **cactiform fascicled hairs** along margin; **F** *H. caudice*: **unilaterally enlarged cilia** on and along margins gradually merging into narrow-rimmed scales. Scale bars: **A**, **C**, **E** 100 µm; **B**, **D** 500 µm; **F** 200 µm. — **A** *I.R.Telford 1954*; **B** *D.L.Jones 1463*; **C** *L.A.Craven 6348*; **D** *K.G.Brennan 3821*; **E** *M.Lazarides 7880*; **F** *P.I.Forster 6102*.

many radiating connate hairs. Although these scales have in contrast to the narrow-rimmed peltate scales usually more than 15 teeth in the centre of the scale, this number is often reduced on the odd smaller scales, so that the relative rim size is a more reliable distinguishing feature. These large scales are characteristic of and only found on species of the *H. lepidota* subgroup.

D. Specialised hairs on margins, mainly of calyx and bracts.

8. **Stellate cilia** (Figs. 1L & 2E) are rosette-like fascicled hairs, which are usually more or less laterally compressed as the margins of the inner calyx become sharp-edged to membranous. The larger marginal hairs are reduced from few to ultimately one arm on a more or less pronounced tubercle often without the vestigial arms in the centre at its apex. These cilia occur only on the margins and are distinct from fascicled hairs/scales (without intermediates in contrast to unilaterally enlarged cilia) next to them on the abaxial side of mainly the inner calyx lobes of species of the *H. melhanioides* group (rare or absent in the *H. tomentosa* subgroup). In some species and usually on the outer calyx lobes the marginal hairs (= cilia as in Fig. 1L) are narrow-based erect rosette-like fascicled hairs.
9. **Unilaterally enlarged cilia** (Figs. 1A, M & 2F) (or rarely scales in some species of the *H. lepidota* subgroup) are rosette-like fascicled hairs/scales on or next to the margin of the bracts and/or calyx lobes of the *H. tomentosa* group, except for some species of the *H. tomentosa* and *H. stirlingii* subgroups. The extrorse-unilaterally enlarged arms are often much longer than those diagonally opposite on the same hair. The reduced arms in extreme developments are similar to those of the vestigial arms in the centre of the apex. Here the marginal hairs are dorsiventrally compressed in contrast to the laterally flattened stellate cilia, so that the originally centrally placed vestigial arms are usually visible on the lateral base. In the *H. lepidota* subgroup the enlarged arms are often more or less laterally united into a ray (Fig. 1M) or unilaterally enlarged scales, which can be particularly observed on scales on the abaxial surface next to the margin.

   As the hairs and especially the teeth are usually more reduced on the inner calyx lobes, extreme forms resemble stellate cilia as they too ultimately become unicellular simple hairs (cilia in Fig. 1A). In such extreme cases distinction between fascicled hairs and unilaterally enlarged cilia is sometimes no longer possible particularly on inner calyx lobes. Confusion between these two types of hairs can, however, be avoided by examining a range of hairs from the outer calyx lobes (or bracts, which are however rarely as clearly developed) to search for unilaterally enlarged cells next to the marginal unicellular cilia (Fig. 1A).

Arms of hairs

The range of the number of arms of hairs on certain organs of a plant may vary from one group of species to another but rarely among close species. The number of arms of hairs were counted for the description of major organs of each species, but was subsequently found of little taxonomic value, because the vestiture usually consists of a range of larger over smaller hairs. Invariably a few hairs with an intermediate range of the number of arms between the extremes rendered these measurements useless as a tool to distinguish taxa.

The arms are the distal part of a single cell in fascicled hairs. They are subequal and/or unequally long on the same hair; or hairs on the same organ are heteromorphic with some of them only with short arms and others with longer subequal and/or unequally long arms as, for instance, in *H. heterotricha* (Fig. 2A); or hairs with mainly subequal branches except for one much longer one in *H. tridentata* (Fig. 2B). Only limited use can be made out of this endless individual variation. The unequal arms are often also exhibited in irregular scales of, for instance, *H. fractiflexa* or *H. echiifolia.*

The following three **habits** of hair arms are often distinctive for some taxa:

- **Erect** arms (with an angle of > 70 degrees from the leaf surface, Fig. 1D) occur on branches of, for instance, *H. angulata*.
- **Spreading** arms (with an angle of < 70 but > 30 degrees from the leaf surface, Fig. 1B, E) are commonly found in the §*Tomentosae*.
- **Reflexed** or **appressed** arms to the upper leaf surface of, for instance, forms of *H. oblongata* subsp. *oblongata* (hair arms parallel to surface or heading towards it, Fig. 1F).

Denseness

The denseness of the vestiture is very difficult to assess, firstly because the organs, like leaves or branches, elongate to a varying extent in different developmental stages (young and fast growing as opposed to senescent growth: cf. leaves) and/or under different environmental conditions. Similarly preliminary counts of hairs per unit area showed that scales or denser hairs cover much more of the epidermis below than a similar number of sparser but equally large hairs. Hairs or scales on the undersurface of leaves of species of the *H. lepidota* subgroup, for instance, are arranged in several layers and their numbers per unit area are very difficult to assess. As there is no simple meaningful way to compare the number of hairs or scales per unit area, the following rough descriptive indications are used. This measure was found more important for scales because of the absence of specific descriptive terminology, such as pubescent or tomentose in the case of hairs, which already contain an indication of denseness.

- **Sparse**: meaning scattered trichomes.
- **Moderate**: There is still some epidermis visible between the perimeter of different hairs and/or scales.
- **Dense**: The hairs/scales cover the epidermis with limited overlap.
- **Very dense**: The overlap of hairs/scales is so much that they form different layers (Fig. 2D).

Juvenile stages of hairs

Although a similarity in the shape of juvenile leaves to those on coppicing branches is obvious, the hairs of such branches and leaves seem to be already adult forms, which are different from hairs found on seedlings at different stages. One sheet with two complete seedlings of *H. tomentosa* (*R.Fensham 701*) revealed that the first few hairs on the first leaf and on the stem immediately above the cotyledons were rosette-like fascicled, though with very few spreading arms. Their number and the number of arms on them rapidly but gradually increased particularly on the undersurface of successive leaves. The only other complete seedlings examined were those of *H. fractiflexa* subsp. *filicaulis* (*J.L.Egan 4796 & S. Knox*) where the juvenile stages are restricted to the first few leaves and from the sixth leaf on only adult type narrow-rimmed scales are found. The tomentum of the first leaves and branches is sparse and consists of scattered rosette-like fascicled hairs with usually unequally long arms, some of which are considerably longer. Successive leaves and the branches in between become more covered with rosette-like fascicled hairs with subequal arms, which become commonly connate to form the narrow-rimmed scales typical of the subspecies. From the fifth or sixth leaves the whole plant is sparsely to moderately densely covered with scales only.

All seedlings investigated showed few fascicled hairs on the epicotyl but none on the hypocotyl, as also Clifford (1987) recorded for *Hibbertia*. Their numbers gradually increase and develop adult shapes more or less concurrent with those on the leaves.

The distinct difference of multiangulate fascicled hairs of the *H. hermanniifolia* group (Toelken, in prep.) and rosette-like ones of the *H. tomentosa* and *H. melhanioides* groups without intermediates in juvenile hairs (cf. Seithe 1962, p. 266), — even though it is based on only two examples of seedlings — increases the significance of this same difference in adult hairs of the three groups. No intermediates between the two types of hairs have yet been observed even in the *H. melhanioides* group where many species have apparently similar hairs with a very narrow base and often only 1–3 vestigial arms in the centre, particularly in species of the *H. melhanioides–H. velutina* complex. However, no seedlings of those species have yet been examined.

A detailed evaluation of the juvenile developments of the hairs in key species of the §*Tomentosae* could contribute to a clearer understanding of the phylogeny of the taxa.

Conclusions and discussion

The characters of the vestiture provide a powerful tool not only for delimiting taxa but also in assessing relationships within the §*Tomentosae*. However, here too, as in characters of the gross morphology, constant awareness of a wide range of variation and/or convergence needs to be maintained as, for instance, there is evidence that scales have developed in as much as five different subgroups of the §*Tomentosae* (cf. conclusions in gross morphology). The characters of the vestiture are not an easy means for distinguishing taxa as the different types of hairs also show intermediates: e.g. at times it is difficult to decide when a fascicled hair becomes a cactiform hair (cf. Fig. 2A) or a ciliate scale (cf. Fig. 1I). There are also the well defined species and those less distinct as, for instance, *H. brevipedunculata* shows a very wide range of variation of hair types: from fine erect to reflexed rosette-like fascicled hairs and peltate scales on leaves and branches. It has also a wide distribution ranging from the Northern Territory to Western Australia with a number of different local forms none of which could be clearly delimited even as infraspecific taxa.

While the vestiture on branches and the undersurface of leaves is often very similar, the tomentum often differs between the leaf surfaces; it is usually denser and often somewhat modified on the undersurface. The vestiture of the upper surface does not change very much from the juvenile stage to that of adult plants except for becoming slightly denser and often more uniform on mature leaves. In contrast, the undersurface usually changes much, presumably because all stomata are borne here. The undersurface in juvenile leaves is usually less hairy than the upper surface, but becomes much more densely hairy except in the *H. echiifolia* and the *H. orbicularis* subgroups and a few species in the *H. stirlingii* subgroup. While this is probably a retention of a juvenile characteristic in species of the *H. orbicularis* subgroup, a similar development in the other species seems to be connected to the development of narrow-rimmed scales as in *H. echiifolia* and *H. stirlingii* subgroups. Broad-rimmed scales of the *H. lepidota* subgroup are very dense and usually layered at least on the undersurface.

Limited material of mainly regenerating juvenile leaves and a few actual seedlings were examined but only one specimen of *H. tomentosa* and two of *H. fractiflexa* subsp. *filicaulis* were available with a full sequence right back to the first leaf. These specimens had early leaves with rosette-like fascicled hairs with a few spreading unequal arms and only a few vestigial arms in the centre of the hairs were already present on the first leaves. In the case of *H. fractiflexa* subsp. *filicaulis* all the hairs were replaced with denser narrow-rimmed scales within the first six leaves. However, no examples of first leaves on seedlings of any other species of the §*Tomentosae* were available and the full range from simple to fascicled hairs as recorded for the

H. aspera group (Toelken 1998, Fig. 1) has not been found. Not even normal fascicled hairs as commonly found in eastern Australian species as, for instance, in the separate but very similar *H. hermanniifolia* group, were observed in any seedlings (even those missing the first leaf) from other species of the §*Tomentosae* examined.

It is noteworthy that many species of the *H. sericea* (R.Br. ex DC.) Benth. group (Toelken 2000) have fascicled hairs and they have developed tufts of stiff hairs in the axil of the leaves (intrapetiolar) below flowers, a character only observed in the two species of the *H. echiifolia* subgroup within the §*Tomentosae*. While these tufts of hairs in the axils are dense, stiffly erect and colourless in the *H. sericea* group, they are sparse, more or less twisted and brown in the *H. echiifolia* subgroup. The cilia of the calyx of particularly *H. echiifolia* are also often brown (a brown amorphous deposition, presumably tannins, occurs in the lumen of the cells) as are those of *H. rufociliata* and some forms of *H. caudice*, but the latter two have no axillary tufts.

Although forms of *H. complanata* subsp. *complanata* and *H. fractiflexa* subsp. *fractiflexa* of the *H. oblongata* subgroup often produce larger scales on the leaves when compared to those of the *H. lepidota* subgroup, they have smaller scales, which scarcely overtop the margins on the petiole and the vein-end. In many species of the *H. lepidota* subgroup the spreading arms of the unilaterally enlarged cilia are also more or less fused to produce scales that overtop the margins of at least the outer calyx lobes.

However, the significance of larger marginal hairs on the calyx and specifically the convergent development of stellate cilia and unilaterally enlarged cilia in different subgroups is difficult to assess, except that it is associated with flowers and the long cilia are possibly part of the flower biology.

Similarly, the question why scales have only developed over the whole plant in *Hibbertia* §*Tomentosae* and in addition appear to have formed independently in five different groups, remains unanswered. In the absence of records on the developments of seedlings for all species of §*Tomentosae* only a few observations can be made:

- Scales have developed from different types of rosette-like fascicled hairs, as was described for successive juvenile leaves of *H. fractiflexa* subsp. *filicaulis*. Intermediate stages have also been observed on leaves of *H. auriculiflora* subsp. *auriculiflora* (Fig.1I).
- Scales and/or ciliate scales are found on the ovaries of all species, but in addition they are also progressively found in different species on the outer and/or inner calyx lobes and the bracts. In only a few species in different subgroups the whole plant is covered with scales. One must assume that a predisposition exists for rosette-like fascicled hairs to develop into scales but the evolutionary stimulus/ pressure for this progression is unknown.
- The proliferation of scales to cover the whole plant is not restricted to certain geographic regions, as there are three out of nine species in Western Australia; five out of 16 species in Queensland and 11 out of 33 species for the Northern Territory which possess this character. *H. lepidota* is probably the most widespread species in the whole group and occurs in all three States, while many of the species are local endemics.
- There are no species with scales covering the whole plant in three out of nine subgroups: namely the *H. tomentosa*, *H. orbicularis* and *H. alopecota* subgroups (They include 11 species from the Northern Territory and one from Western Australia). The leaves of the latter two subgroups are, however, suspected of retaining juvenile characters as exhibited by the fewer hairs on the abaxial leaf surface in the *H. orbicularis* subgroup, and frequently lobed adult leaves of the *H. alopecota* subgroup.
- Although the progression of scales over parts and, even more so, over the whole plant is an obvious indication of an advanced character within closely related species, this need not represent part of a linear development within the subgroup. In the *H. lepidota* subgroup, for instance, there are two obvious developmental lines, the linear-leaved ones including *H. lepidota* and the broader ovate-leaved developmental line culminating in *H. pancerea*. The distribution of scales progresses in each developmental line independently.
- The progression of individual types of scales over part or the whole plant has played an important role in assessing the position of individual species within groups or subgroups, but it was always supported by the sum of all characters including those of the gross morphology.

Hair characters important for infrageneric classification

While fascicled hairs are frequently found in *Hibbertia* §*Vestitae* and many other groups in subgen. *Hemistemma* (Horn 2009), rosette-like fascicled hairs, as well as the derived scales, are unique to the §*Tomentosae*.

Marginal cilia on the bracts and/or calyx lobes have developed in two ways and divide the §*Tomentosae* into two natural groups:

Firstly, those of species of the mainly eastern *H. melhanioides* group have become laterally compressed and reduced as the margins of the bracts and calyx lobes become flattened. The stellate cilia still occasionally show one or two vestigial arms on top of the much finer basal tubercle in between two or three extended arms. In extreme cases they are single-celled hairs. These fine marginal cilia and the unusual character of hairs or scales on the style base are characteristics of the *H.*

melhanioides group and are also found in the *H. scabra* and *H. echiifolia* subgroups, although their species occur in the Northern Territory, while the majority of species of the group is found in Queensland.

Secondly, the marginal fascicled hairs of the *H. tomentosa* group, except those of the three species of the *H. tomentosa* subgroup, have become dorsiventrally compressed and the extrorse-unilaterally elongated arms become the cilia of these multi-celled hairs. The central vestigial arms are visible on one side, but disappear when ultimately these hairs become reduced to single-celled marginal cilia.

This distinction of the two groups based on the different marginal cilia, which in some specimens is not easily discernable, is, however, supported by another unique character in *Hibbertia*, that is the presence of hairs and/or scales on the style base of species of only the *H. melhanioides* group.

The presence of unilaterally enlarged cilia in most of the species of the *H. tomentosa* group is here interpreted as an indication that they, the *H. tomentosa* and *H. melhanioides* groups are natural monophyletic groupings in spite of their incredible diversification.

Gross morphology

Habit

Although the habit of the species in the §*Tomentosae* is generally very plastic as in most hibbertias, a woody rootstock with the possibility of annual regrowth is noteworthy mainly in plants from the lowlands or lower escarpment of the Arnhem Plateau in the Northern Territory. New stems from the rootstock first develop a number of closely set scales which grade into fully expanded leaves. Scales are usually well represented on herbarium specimens. Other species without rootstocks may appear similar particularly after they have been burnt, but when they regenerate smaller leaves are immediately followed by full sized ones, although these often show some juveniles characters. These coppicing species usually grow in association with rock faces to rock screes where they seem to get some protection from bush fires, while those taxa with a rootstock, e.g. *H. angulata*, *H. brevipedunculata*, *H. caudice* and *H. cistifolia* are able to regenerate quickly and thus thrive in the mainly fire-prone lowlands.

Juvenile stages of leaves

The first leaves of new branches have often teeth or lobes on the distal margins, particularly on regenerating plants. Usually only a few such leaves are produced before the development reverts back to entire mature leaves. Although seedlings have been recorded for only three species on herbarium specimens of the large §*Tomentosae*, it is obvious that the first leaves on regenerating plants are reminiscent of juvenile stages, i.e. heteroblasty occurs probably in all seedlings and dimorphic leaves are also found on regenerating shoots of at least some of the species. In the absence of seedling material for most species, the leaves based on regenerating/coppicing branches are described as juvenile leaves to draw attention to this dimorphism, but they cannot account for the full range of variation in seedlings of different species.

Each of these teeth or lobes of juvenile leaves terminate in a vein-end similar to those of the leaf apex and/or similar to permanent teeth of leaves of, for instance, *H. grossularioides* (Salisb.) K.D.Koenig & Sims in Bentham's *Hibbertia* §*Hemihibbertia*. Mature leaves are usually entire in the §*Tomentosae* except for *H. solanifolia* and *H. tridentata*. Forms of *H. alopecota* are have more or less lobed adult leaves, but judging by regenerating material their shape is different from juvenile leaves. The latter also have vein-ends on the lobes. All herbarium specimens examined showed no indications that the vein-ends exude water at any stage of their life, i.e. they are not guttation glands as found on leaves of some tropical plants or in genera such as *Saxifraga* and *Crassula* (Toelken 1977).

The importance of seedling morphology in the taxonomy of Australian plants was already shown in 1828 when A.P. de Candolle divided the genus *Eucalyptus* into two sections on this basis, and seedling morphology has now become an intrinsic part of the taxonomy of that genus. The few seedlings known of the §*Tomentosae* differ in the various groupings of species in respect of when and how the lobed leaves are produced before adult leaves develop (see also juveniles stages of hairs, above). The absence of lobed or toothed leaves on regenerating plants of the *H. scabra*, *H echiifolia* and *H. stirlingii* subgroups is also significant and might be comparable to the lack of lobed leaves on adult plants of *H. fractiflexa* of the *H. oblongata* subgroup. In seedlings of *H. fractiflexa* subsp. *filicaulis* only the first two or three leaves are lobed and the next two leaves are entire but broader before the typical narrow adult leaves follow unceasingly (for detail see under species).

These observations indicate that a concerted effort to grow and record seedlings (cf. Clifford 1981, 1987) of as many species as possible of the §*Tomentosae* could provide valuable additional information in an assessment of relations of individual species or groups of species as stated above.

Leaves

The extensive variation in shape and size of leaves is largely due to their dimorphism. While adult leaves are entire, except for a few species, juvenile leaves with lobes and/or teeth are not only found on young plants but are repeated in many species with annual regeneration, coppicing or suckering branches.

Leaves of fast-growing, mainly young branches are often several times larger than those on senescent branches.

A petiole tends to be obvious in most species, but it is very short and indistinct in the *H. stirlingii* and *H. lepidota* subgroups; in the latter large overtopping scales completely obscure it. In most species of the *H. tomentosa* and *H. melhanioides* groups the central vein

on the petiole becomes raised and this ridge, or rarely wing, is continued downwards along the branches. This central ridge is a unique development in the §*Tomentosae* group as in other hibbertias the whole leaf base usually forms a flange-like ridge more or less decurrent on the branches.

The venation, i.e. the central vein, lateral veins and intramarginals, are clearly visible on leaves of most species of the *H. melhanioides*, *H. alopecota* and *H. oblongata* subgroups. The central vein is never as broad as in the *H. sericea* complex (Toelken 2000), but is normally visible in all species unless obscured by extreme vestiture, e.g. *H. lepidota* subgroup.

Leaves are normally flat in the §*Tomentosae*, but the margins are, or often become, recurved to revolute with desiccation and only in the *H. lepidota* subgroup are they more or less incurved. This subgroup can be divided into two groups of species. Some species have incurved leaves that become U-shaped in cross-section as in *H. lepidota*, while other leaves are folded lengthwise, e.g. *H. argyrochiton*, to become V-shaped in cross-section.

Flowers and inflorescences

The peduncles of an inflorescence, each with a single flower, commonly elongate when flowering, but in the §*Tomentosae* further elongate and becomes recurved when fruiting. The bracts strictly subtend the calyx and are usually retained for some time at the apex of the peduncle in most species, even after the flower has been shed. The vestiture at the base of the peduncle is often different from that below the flower, so that it was not used in the description of hairs of species, but rather that of the more uniform bracts.

In all species the flowers are strictly terminal, i.e. they are monads or derived thereof and are associated with sympodial growth, but the peduncle often becomes not obviously leaf-opposed due to oblique growth. Successive flowers are usually produced at intervals of two nodes, but the internodes may be much reduced as in the *H. sericea* group (Toelken 2000). Flowers are borne on terminal and/or "axillary" branches, and the latter are often more or less reduced to short shoots. These flowers appear to be "axillary", but the presence of scale-like prophylls confirms a reduced axillary branch with a monad/s. Some branched stems of *H. brevipedunculata*, for instance, show a full range of intermediates from well-developed axillary branches to short shoots with terminal flowers (cf. Fig. 10A). In extreme cases, for instance, in *H. cymosa* 1–5 flowers in a leaf axil or a cincinna-like polymonad (cf. Toelken 2000) can be observed, because the flowers are all facing in one direction. Such extreme reductions of whole axillary branches are only known from the §*Tomentosae*, but single "axillary" flowers have also been observed in other species of *Hibbertia* subgen. *Hemistemma* as, for example, in *H. rufa* N.A.Wakef. or *H. exutiacies* N.A.Wakef.

The inflorescences vary from complex thyrses to thyrsoids (Briggs & Johnson 1979), but each with some individual variation even within species, so that specific descriptions could often become confusing. In most species the inflorescences are spiciform (basitonous), while they assume a more or less corymbiform (acrotonous) shape in *H. eciliata* and *H. echiifolia*.

For convenience, therefore, it is here distinguished between firstly, leaf-opposed **terminal flowers**, viz. monads, which are separated by at least two leaves and more or less elongated internodes, such as in *H. tomentosa* (Fig. 8A); secondly, 1–5 **"axillary" flowers**, i.e. monads or polymonads (together with more or less reduced leaves borne on a variously shortened axillary branch) in the axils of successive leaves, e.g. *H. caudice* (Fig. 13E). In some plants of some species, e.g. *H. brevipedunculata* and *H. lepidota,* the terminal branch often has terminal flowers, while on other plants or on other branches of the same plant a compound inflorescence is observed. Plants with "axillary" flowers have usually many more flowers because they bear 1–5 flowers in the axil of successive leaves of branches.

The shape of flower buds is usually characteristic of individual groups. The calyx closes immediately after flowering, so that buds in the fruiting stage are similarly recognizable until seeds are bulging when they are maturing. The slender ovoid buds usually with a pointed to almost beaked apex become ellipsoidal when fruiting. They are mainly restricted to the *H. melhanioides* group. Spherical to pyriform (when fruiting) buds are characteristic of most of the species of the *H. tomentosa* group except for the three apparently primitive species of the *H. tomentosa* subgroup. It is interesting to note that there is a tendency in *H. echiifolia*, which belongs to the *H. melhanioides* group to develop spherical buds while they are ellipsoidal in the closely related *H. guttata*.

Flowering times, as provided in the descriptions, were obtained from herbarium specimens. The information is, however, of limited use, because it was found, at least on the more commonly collected species, that, like most hibbertias, they are opportunistic and some flowers can be found throughout the year. In the drier months of July to October less frequent flowering is offset by better access for collectors in northern Australia.

Calyx

In the §*Tomentosae* usually two outer and three inner calyx lobes can be distinguished, as in other hibbertias. However, in the case of acute or beaked flower buds there are sometimes three outer and two inner lobes, particularly in presumed more primitive species. At times, a number of intermediates can be observed within the same species. This character is often a subjective personal interpretation and placed in brackets in the description. In the majority of species of the §*Tomentosae* there are only two distinct outer and three obovate inner calyx lobes, and the apices of all five are erect in ovoid to ellipsoidal buds, while in those species with spherical to pyriform buds the inner calyx lobes usually have a more rounded to incurved apex.

Stamens

The stamens vary greatly in number (ten in *H. stirlingii* and up to eighty have been reported for *H. cymosa*) and size. They are always arranged around the ovaries, but rarely in clear groups. The filaments are scarcely connate basally.

Staminodes are often present particularly dorsally (towards the stem) and laterally. Their filaments are usually slightly finer and drawn into a blunt point, which is often paler. However, no pattern could be established with regards to their position and number, even within the same species.

Anthers are normally narrowly obloid and, although some seem to dehisce initially by apical pores, all of them develop lateral splits. Species of the *H. tomentosa* group have subequal anthers, rarely more than 1.5 mm long, while they are usually longer and of two sizes in most of the species of the *H. melhanioides* group. Species of the subgroups *H. echiifolia* and *H. scabra*, in particular, have some anthers up to 4 mm long and they also develop distinctly longer filaments at flowering time, so that the flowers have anthers at two levels, which may indicate a different pollination syndrome.

Ovary

Species of the §*Tomentosae* commonly have two pistils, but in the *H. melhanioides* and *H. echiifolia* subgroups, often three or rarely even four were observed. Each ovary usually has 2 basal ovules, but the number of ovules per ovary also varies in the latter two subgroups from four to six. More than two ovules are attached to the centripedal suture of each ovary. The style is usually attached to the apex of the ovary and only in some taxa of the *H. tomentosa* group it varies from a dorsal to a lateral position close to the apex as, for example in *H. fractiflexa*.

Seeds

While a considerable variation in the size of the aril was observed between species, these differences do not allow grouping. The clasping cup-shaped basal part of the aril often becomes quite fleshy, for instance in *H. oblongata*, but since it is impossible to clearly assess in herbarium material whether seeds were fully mature when picked, this character remained inconclusive.

Conclusions and discussion

A very wide range of variation was found in the gross morphology and in particular in the vegetative characters of the §*Tomentosae*. Decurrent leaf bases are more or less well developed in various hibbertias, but in the §*Tomentosae* a ridge continued from the central vein on the abaxial leaf surface onto the petiole and internode below usually develops a sharp edges or becomes winged in extreme cases. A full range from terete stems to ridged or winged branches can be observed in the *H. lepidota* subgroup. These ridges are unique within the genus.

The lobed leaves of juvenile plants which are commonly observed in regenerating branches of most species of the §*Tomentosae* are also unique within *Hibbertia* subgen. *Hemistemma*, but have also been recorded for the subgenera *Hibbertia* and *Pachynema*. Toothed leaves are retained in adult (fruiting) plants of *H. solanifolia* and *H. tridentata* as well as in some forms of *H. alopecota* and *H. caudice*, but they too are no longer the shape and size of the juvenile leaves. Throughout their development the leaves change their shape and the number of teeth, but there appear to be patterns within groups of species, e.g. leaf dimorphism is unknown from the *H. scabra*, *H. echiifolia* and *H. stirlingii* subgroups. This might be due to a very short juvenile stage as described for *H. fractiflexa* subsp. *filicaulis*, which also does not exhibit lobed leaves of new or regenerating branches. A study of the leaf development of all species could not only benefit taxonomic use but would also add valuable support to the supraspecific grouping of the §*Tomentosae*.

A phylogenetic tree (Horn 2005, 2009) based on DNA (ITS nrDNA and rpl16 intron cpDNA) and floral characters includes only five species of the §*Tomentosae* and thus does not contribute to the grouping of the species. However, it clearly demonstrates the isolated position of §*Tomentosae* next to the small Western Australian *H. drummondii* (= *H. ochralasia*) group. These two form a sister group to sect. *Hemistemma sensu* Benth. from tropical Australia and New Caledonia. The three groups are as a unit well separated from the bulk of species from temperate eastern Australia now included by Horn (2005, 2007, 2009) in his subgen. *Hemistemma*.

Furthermore, the two major groups within the §*Tomentosae* have distinctive morphological characteristics, such as the commonly unequally long anthers (heterantherous) and ovoid to ellipsoidal flower buds of the *H. melhanioides* group and the subequal anthers and almost spherical to obovoid or pyriform buds of the *H. tomentosa* group, in addition to different marginal cilia and a style base with or without hairs and/or scales respectively. While the greater number of species of the *H. melhanioides* group occurs in northern Queensland, the species of the *H. tomentosa* group are predominantly found in the Northern Territory; species from Western Australia are either extending their distribution from the Northern Territory or are related to them.

The position of several contentious species needed clarification:

- The subequal stamens of species of the *H. tomentosa* subgroup determine its present position in spite of its beaked ovoid buds.
- The *H. scabra* and *H. echiifolia* subgroups, which almost entirely occur in the Northern Territory, are easily distinguished as member of the *H. melhanioides* group by their obviously heterantherous flowers. While species of the *H. scabra* have also ellipsoidal buds, those of *H. echiifolia* show a tendency for buds to become

more spherical although they are also ellipsoidal in *H. guttata*, the second species in the *H. echiifolia* subgroup.

- A number of specimens previously identified as *H. echiifolia* in Western Australia were described as *H. complanata*, as they have "axillary" flowers with almost globular buds and subequal anthers, and, most significantly, the absence of intrapetiolar tufts. These characters furthermore indicate that *H. complanata* is only superficially similar to *H. echiifolia* and should rather be placed in the *H. oblongata* subgroup of the *H. tomentosa* group, where it shows closest affinity to *H. fractiflexa,* because of the "axillary" flowers and small scales along the stems. *H. echiifolia* is known only from four scattered records in Western Australia.
- A very similar use of gross morphology and vestiture, i.e. the spherical flower buds and subequal anthers as well the broad-rimmed scales overtopping the margins of in particular the petiole indicates that the Queensland endemic, *H. pholidota,* should be placed in the predominantly Northern Territory *H. lepidota* subgroup.
- In a similar way, by comparing gross morphology with vestiture, it can be demonstrated that scales, which are unique to *Hibbertia*, have developed independently. Examples of this can be found in five different subgroups, each of which includes some species with only rosette-like fascicled hairs. Just like the full range from fascicled hairs to predominantly narrow-rimmed scales is found in forms of *H. brevipedunculata,* scales also occurs in *H. eciliata* in the *H. melhanioides* subgroup; in *H. echiifolia* in the *H. echiifolia* subgroup; in *H. complanata*, *H. fractiflexa*, forms of *H. brevipedunculata* in the *H. oblongata* subgroup and in *H. stirlingii* in the *H. stirlingii* subgroup, whereas predominantly broad-rimmed scales are usually restricted to forms of *H. auriculiflora*, *H. ciliolata*, *H. lepidota*, *H. marrawalina*, *H. sulcata*, *H. pholidota*, *H. brennanii*, *H. argyrochiton*, *H. incurvata*, *H. pancerea* in the *H. lepidota* subgroup.

Taxonomy

This taxonomic treatment, which was based on limited material for many species, will require further adjusting. However in order to compensate for this deficiency a wide range of hair characters were added to the gross morphology and hopefully the two-pronged approach provided a more balanced study.

Species are systematically arranged; the provisional numbering of the species used here for convenience will need to be changed once the whole genus has been revised.

Since most types were examined, only those few which were not seen were marked 'n.v.' This applies mainly to duplicates of collections selected here as types of new taxa, of which specimens were reported on their labels to have been distributed to various herbaria.

Lectotypes are selected for species described by Bentham, because he consulted R. Brown's herbarium before it was divided up and duplicates distributed to various herbaria. Although J.J. Bennett had attempted to number individual collections in Brown's herbarium (Groves 2006), he was not always successful. It could be shown for three species, *H. lepidota*, *H. oblongata* and *H. echiifolia*, that the Bennett number included two collections from different localities and dates as recorded on Brown's original label. The holotypes in Geneva (G-DC) presented no problems because they always consisted of a single specimen, but it was not always easy to align them with isotypes from Brown's herbarium distributed simply under the specific Bennett number. The approach varies individually as in the case of *H. lepidota* the isotypes could easily be identified from the second collection under the same Bennett number, but the two collections of *H. oblongata* and *H. echiifolia* were indistinguishable unless accompanied by an original label (cf. typification of the respective species).

In the descriptions measurements were usually divided into a range most commonly found on herbarium specimens and extremes were bracketed, but this formula could not be used in the case of some species with a number of subspecies, or when the taxon was based on a single or few specimens. The dimensions of leaves and internodes of young branches, especially those regenerating and just starting to flower, are often two to three times larger than those of fruiting material collected towards the end of the season.

The term **undersurface of leaves** excludes, in keeping with previous use (Toelken 1998, 2000), the central vein of the abaxial leaf surface and the revolute margins of the adaxial leaf surface, because both these often have a different vestiture from the undersurface.

As the bracts always subtend the flowers there is no easy way to distinguish them from especially the outer calyx lobes. They are generally smaller and more slender in species of the *H. melhanioides* group, but in the *H. tomentosa* group they are often as broad as the outer calyx lobes and in some cases, as for instance in *H. tricornis*, they are almost equal to them.

Key to supraspecific groupings of *Hibbertia* §*Tomentosae*

Common characters: Peduncle commonly longer than 5 mm, with bracts subtending calyx; stamens arranged arround the ovary; pistils 2 (rarely up to 4), each ovary with usually 2 ovules; vestiture of multiangulate rosette-like fascicled hairs to often peltate scales.

See Tab. 1 for a list of species and informal groups within *Hibbertia* §*Tomentosae* (p. 2).

A. Style base with hairs/scales; anthers unequally long; flower buds ovoid to ellipsoidal with inner calyx lobes usually acute (except *H. cymosa*) ..... 1. ***H. melhanioides*** group — see **Key I** (below) for species

B. Shrubs with 1 to few stems; branches stiff, erect-spreading

C. Anthers of same flower displaying a range of sizes; cilia on calyx fine, white; flower buds narrowly ovoid to ellipsoidal; Qld. ..... 1.1. ***H. melhanioides*** subgroup

CC. Anthers of same flower in two sizes (heterantherous); cilia on calyx coarse, brown; flower buds obovoid to pyriform; WA, NT, Qld. ..... 1.3. ***H. echiifolia*** subgroup

BB. Shrublets multistemmed from rootstock; branches wiry, decumbent or prostrate; NT ..... 1.2. ***H. scabra*** subgroup

AA. Style base without hairs/scales; anthers subequally long; flower buds spherical with inner calyx lobes usually rounded (except for the *H.tomentosa* subgroup) ..... 2. ***H. tomentosa*** group — see **Key II** (next page) for species

D. Flower buds ellipsoidal with inner calyx lobes acute; NT ..... 2.1. ***H. tomentosa*** subgroup

DD. Flower buds spherical to pyriform with inner calyx lobes rounded

E. Undersurface of leaves less hairy than upper surface; WA, NT ..... 2.2. ***H. orbicularis*** subgroup

EE. Undersurface of leaves more densely hairy than upper surface

F. Abaxial petiole with longer spreading hairs (short-hirsute); WA, NT ..... 2.3. ***H. alopecota*** subgroup

FF. Abaxial petiole with short hairs (tomentose) and/or with reflexed longer hairs/scales (pubescent)

G. Few larger hairs on abaxial surface of petiole and terminal vein-end

H. Leaf lamina mainly oblong-elliptic with ± flat margins; peduncle ± robust; WA, NT . 2.4. ***H. oblongata*** subgroup

HH. Leaf lamina mainly linear to linear-oblanceolate with recurved to revolute margins; peduncle slender filiform; NT, Qld ..... 2.5. ***H. stirlingii*** subgroup

GG. Predominantly larger hairs/scales on abaxial surface of petiole and terminal vein-end; WA, NT, Qld ..... 2.6. ***H. lepidota*** subgroup

I. Key to the species and infraspecific taxa of the *H. melhanioides* group

Common characters: Style base usually with peltate scales or rarely fascicled hairs; anthers usually unequal, (1.3–) 1.5–2.5 (–4.8) mm long; flower buds ellipsoidal with acute rarely obtuse inner calyx lobes; vestiture with rosette-like fascicled hairs to rarely peltate scales.

1. Branches and/or undersurface of leaves covered with spreading rosette-like to cactiform fascicled hairs (see Fig. 2A)

2. Abaxial petiole mainly covered with long-spreading hairs (hirsute)

3. Leaves linear to linear-oblanceolate, 2.2–5.7 mm broad; 66–74 stamens ..... 6. ***H. mulligana*** (Qld)

3: Leaves elliptic to lanceolate to oblanceolate, usually > 6 mm broad or if less then < 64 stamens

4. Arms of hairs on the central vein on the undersurface of leaves all long, silky and erect

5. Stamens 50–55; leaf apex rounded, rarely mucronate; inland mountains (Many Peaks Range) .... 4. ***H. malacophylla*** (Qld)

5: Stamens 34–40; leaf apex usually acute to cuspidate; coastal sand ..... 5. ***H. velutina*** (Qld)

4: Arms of hairs on the central vein on the undersurface of leaves long and short, spreading

6. Stamens up to 26; arms of hairs on central vein on undersurface of leaves mainly short; pistils 2 ..... 1. ***H. bicarpellata*** (Qld)

6: Stamens 30–60; long arms of hairs on central vein on the undersurface of leaves long and silky; pistils predominantly 3

7. Stamens 37–48; upper leaf surface usually ± grooved along the central and lateral veins . 3. ***H. heterotricha*** (Qld)

7: Stamens 50–60; upper leaf surface scarcely grooved along the central vein ..... 2. ***H. melhanioides*** (Qld)

2: Abaxial petiole covered with short-armed or reflexed hairs (pubescent)

8. Shrubs with one to few stems, with woody branches; anthers up to 2.5 mm long

9. Stamens 20–26; pistils 2 ..... 1. ***H. bicarpellata*** (Qld)

9: Stamens 40–45; pistils 3 ..... 7. ***H. araneolifera*** (Qld)

8: Subshrubs multistemmed , with wiry branches; some anthers 2.5–3.7 mm long

10. Leaf lamina usually > 3mm broad; calyx lobes with some fascicled hairs on the inside

11. Leaf lamina usually (2.1–) 5.0–12.5 (–21.2) mm broad; margins recurved, rarely revolute and with ± appressed hairs ..... 9. ***H. cistifolia*** (NT)

11: Leaf lamina 3–8 mm broad; margins strongly revolute, with longer spreading hairs ..... 10. ***H. incompta*** (NT)

10: Leaf lamina (0.7–) 1–2 (–2.4) mm broad; calyx lobes without fascicled hairs on inside ..... 11. ***H. scabra*** (NT)

1: Branches and/or undersurface of leaves covered with ciliate to entire scales, rarely mixed with cactiform fascicled hairs

12. Calyx lobes acute, with pale cactiform fascicled hairs and narrow-rimmed scales and usually eciliate; leaf axils without brown simple hairs; pistils 2 ..... 8. ***H. eciliata*** (Qld)

12: Calyx lobes rounded or obtuse, often with brown marginal cilia; leaf axils with brown simple hairs particularly around flowers; pistils 3 (4)
13. Leaf lamina linear to linear-oblanceolate, 1.9–4.0 (–5.7) mm broad; vestiture scales with cactiform fascicled hairs buds ellipsoidal to ovoid-ellipsoidal ..... 12. ***H. guttata*** (NT)
13: Leaf lamina elliptic-lanceolate to oblong, 0.9–17.2 mm broad; vestiture of mainly scales; buds almost spherical to pyriform ..... 13. ***H. echiifolia*** (WA, NT, Qld)
14. Calyx lobes 9–14 mm long; longest anthers 3.5–3.9 mm long ..... 13c. ***H. echiifolia*** subsp. ***macrantha*** (NT)
14: Calyx lobes 6–8 mm long; longest anthers 2.2–3.2 mm long
15. Leaf apex shortly acuminate, with simple hairs on point; leaf surface fascicled-hairy/ciliate-scaly ..... 13e. ***H. echiifolia*** subsp. ***rotata*** (NT)
15: Leaf apex cuspidate, mucronate, with peltate scales and/or fascicled hairs; leaf surface mainly scaly
16. Branches (except nodes) ± glabrous; flowers subsessile (< 2 mm), with ellipsoidal buds ..... 13b. ***H. echiifolia*** subsp. ***cernua*** (NT)
16: Branches and nodes densely scaly; flowers pedunculate (3–8 mm), with spherical buds
17. Outer calyx subequal to inner ones; flowers solitary, terminal, with fully developed leaves between successive ones ..... 13a. ***H. echiifolia*** subsp. ***echiifolia*** (WA, NT, Qld)
17: Outer calyx lobes 1/2–2/3 length of inner ones; flowers in terminal clusters of 1–3 (–5) ..... 13d. ***H. echiifolia*** subsp. ***oligantha*** (NT)

II. Key to the species and infraspecific taxa of the *H. tomentosa* group

Common characters: Style base without hairs or scales; anthers subequal, usually (0.6–) 0.8–1.3 (–1.5) mm long; buds spherical to pyriform with rounded inner calyx lobes (except for *H. tomentosa* subgroup); vestiture with rosette-like fascicled hairs to peltate scales.

1: Undersurface of leaves and branches with rosette-like to cactiform fascicled hairs (see Fig. 2A)
2. Vestiture on undersurface of leaves less dense (rarely as dense as) than on the upper leaf surface (a feature also typical of juvenile leaves)
3. Leaf lamina broadly elliptical to orbicular; stamens > 30 ..... 19. ***H. orbicularis*** (NT)
3: Leaf lamina elliptic to oblanceolate; stamens < 30
4. Shrublets with spreading ± rigid branches; leaves and branches with rosette-like and cactiform fascicled hairs ..... 39. ***H. stelligera*** (Qld)
4: Shrublets with decumbent wiry branches; leaves and branches with rosette-like fascicled hairs
5. Stamens 13–15; upper surface of petiole with bristle-like arms of the fascicled hairs ..... 18. ***H. scopata*** (WA)
5: Stamens 26–28; upper surface of petiole with similar vestiture as upper leaf surface ..... 17. ***H. cactifolia*** (NT)
2: Vestiture of undersurface of leaves as dense but usually distinctly denser than on upper leaf surface
6. Flower buds ellipsoidal; outer calyx lobes beaked and inner ones pointed and without cilia on margins
7. Plants with single or few stems, re-establishing from seed; leaf margins rarely slightly recurved ..... 14. ***H. tomentosa*** (NT)
7: Plants multistemmed, regeneration from rootstock; leaf margins revolute
8. Stamens 17–19; prominent ridges on outer calyx lobes; rosette-like fascicled hairs of leaves with long spreading arms ..... 15. ***H. angulata*** (NT)
8: Stamens ca 12; rosette-like fascicled hairs on leaves with very short arms and usually reflexed ..... 16. ***H. ligulata*** (NT)
6: Flower buds spherical or pyriform; inner calyx lobes rounded, rarely obtuse, outer ones with unilaterally enlarged marginal fascicled hairs
9. Pistils (3) 4 per flower ..... 36. ***H. oligocarpa*** (NT)
9: Pistils 2 (3) per flower
10. Petiole with long spreading hairs (hirsute)
11. Peduncle filiform, 0.3–0.4 (–0.5) mm broad and often > 20 mm long
12. Leaf margins sinuate-lobed; erect perennial ..... 22. ***H. solanifolia*** (NT)
12: Leaf margins entire (except on juvenile leaves); decumbent to prostrate perennial
13. Leaf lamina oblong-oblanceolate ..... 33. ***H. cymosa*** (Qld)
13: Leaf lamina broadly elliptic, obovate to almost circular
14. Leaf lamina broadly elliptic to circular; bracts broadly ovate, clasping peduncle; stamens c. 30 ..... 23. ***H. circularis*** (NT)
14: Leaf lamina elliptic; bracts linear-lanceolate; stamens 19–24 ..... 24. ***H. tricornis*** (NT)
11: Peduncle strap-like to broadly terete, robust, (0.6–) 0.8–1 (–1.2) mm and rarely longer than 12 mm
15. Leaf lamina oblong-elliptic, usually > three times longer than broad
16. Plant covered with long silky fascicled hairs (long-hirsute) ..... 25. ***H. mollis*** (WA)
16: Plant covered with short spreading to appressed fascicled hairs (velvety-pubescent) ..... 27. ***H. oblongata*** (WA, NT)
17. Bracts elliptic, elliptic-oblong, rarely oblong-lanceolate, narrowed at base or subpetiolate; flower buds usually obovoid becoming pyriform with base scarcely broader than peduncle

18. Leaves discolourous; upper leaf surface with reflexed hairs with arms short, up to 2.5 times the diameter of the basal tubercle (epidermis usually showing between hairs) ..... 27a. ***H. oblongata*** subsp. ***oblongata*** (NT)

18: Leaves not obviously discolourous; upper leaf surface with erect-spreading hairs with arms longer, 3–5 times the diameter of the basal tubercle and usually very dense with no epidermis showing ..... 27b. ***H. oblongata*** subsp. ***brevifolia*** (WA, NT)

17: Bracts ovate to oblong-ovate, not narrowed at base or auriculate and ± clasping peduncle; flower buds spherical becoming obovoid, rarely pyriform with base distinctly broader than peduncle

19. Stamens 30–36; anthers obloid, (0.8–) 1.1–1.5 mm long; leaves sessile or with petiole 0–0.5 mm long ..... 27c. ***H. oblongata*** subsp. ***macrophylla*** (NT)

19. Stamens 18–22 (–33); anthers ± conical, (1.6–) 1.8–2.6 (–3.2) mm long; leaves with petiole (0.4–) 0.8–1.5 (–2.4) mm long ..... 27d. ***H. oblongata*** subsp. ***megalanthera*** (NT)

15: Leaf lamina elliptic to elliptic-lanceolate, < three times longer than broad

20. Flowers terminal and at intervals of at least two nodes ..... 27. ***H. oblongata*** complex (WA, NT) (for subspecies see **17**)

20: Flowers "axillary" and at successive nodes

21. Leaf lamina ovate to elliptic, rarely obovate, entire or toothed when young; arms of hairs on adaxial leaf surface slightly unequal ..... 20. ***H. alopecota*** (NT)

21: Leaf lamina obovate, with 3 teeth; one branch of some hairs on the adaxial leaf surface up to 3 times longer than others ..... 21. ***H. tridentata***(NT)

10: Petiole with short hairs or hairs appressed (pubescent, velutinous, strigose)

22. Leaf margins recurved to revolute on most leaves

23. Peduncle short and stout; leaf lamina oblanceolate

24. Flower buds ellipsoidal, 4.5–6 mm long; upper leaf surface densely hairy ..... 26. ***H. brevipedunculata*** (WA, NT)

24: Flower buds spherical or pyriform, 3–4 mm in diameter; upper leaf surface sparse to moderately hairy ..... 32. ***H. rufociliata*** (Qld)

23: Peduncle filiform and long; leaf lamina linear, linear-oblanceolate

25. Leaf margins strongly revolute and undersurface rarely visible ..... 41. ***H. pilulis*** (NT)

25: Leaf margins ± recurved and undersurface visible

26. Undersurface of leaves sparsely hairy, scarcely denser than upper leaf surface .... 39. ***H. stelligera*** (Qld)

26: Undersurface of leaves densely hairy, obviously more densely hairy below than above

27. Shrubs erect, spindly; flowers terminal; vestiture ± uniform ..... 42. ***H. malleolacea*** (NT)

27: Shrublets sprawling-spreading; flowers "axillary"; vestiture with distinctly larger hairs overtopping smaller ones ..... 37. ***H. extrorsa*** (NT)

22: Leaf margins flat or unevenly recurved on some leaves

28. Perennials multistemmed from a basal rootstock

29. Flower buds ellipsoidal, 4.5–6 mm long ..... 26. ***H. brevipedunculata*** (WA, NT)

29: Flower buds ± spherical, 3–4 mm in diameter

30. Bracts ovate, peduncle-clasping; upper leaf surface with reflexed or appressed hairs ..... 31. ***H. caudice*** (NT, Qld)

30: Bracts linear-lanceolate, not clasping; upper leaf surface with erect-spreading hairs

31. Upper leaf surface stubble-like; stamens 30–36; branches with basal short shoots ..... 29. ***H. suffrutescens*** (WA)

31: Upper leaf surface velutinous; stamens 42–50; branches without basal short shoots ..... 30. ***H. axillaris*** (WA)

28: Perennials with one to few stems, each often much branched

32. Plants erect-spreading, with rigid-woody branches

33. Lower surface of leaves with ciliate to entire scales ..... 44. ***H. ciliolata*** (NT)

33: Lower surface of leaves with rosette-like fascicled hairs

34. Hairs on leaves ± spreading or rarely reflexed; outer calyx shorter or scarcely longer than the inner ones and apex usually recurved ..... 27 ***H. oblongata*** complex (WA, NT) (for subspecies see **17**)

34: Hairs on leaves appressed; outer calyx lobes distinctly longer than inner ones and erect-spreading ..... 43. ***H. auriculiflora*** (NT)

35. Outer calyx lobes (6.6–) 7–7.5 (–8.2) mm long; anthers 25–32 ..... 43a. ***H. auriculiflora*** subsp. ***auriculiflora*** (NT)

35: Outer calyx 5.2–5.7 (–6.0) mm long; anthers 12–18 ..... 43b. ***H. auriculiflora*** subsp. ***minor*** (NT)

32: Plants decumbent, with wiry woody branches

36. Upper leaf surface with fine hairs each with spreading arms at least twice longer than diameter of tubercle

37. Flowers terminal, becoming leaf-opposed (not at successive nodes of branches) ..... 27. ***H. oblongata*** complex (WA, NT) (for subspecies see **17**)

37: Flowers "axillary", born at successive nodes on branches . . . . . 43b. ***H. auriculiflora*** subsp. ***minor*** (NT)

36: Upper leaf surface with coarse hairs, each with reflexed or appressed arms ± as long as diameter of tubercle

38. Vestiture on undersurface of leaves is mixture of ciliate scales and similar fine appressed fascicled hairs . . . . . 28. ***H. orientalis*** (NT)

38: Vestiture on undersurface of leaves similar coarse hairs as on upper surface

39. Several decumbent branches from thickened base . . . . . 29. ***H. suffrutescens*** (WA)

39: Spreading shrub to 1 m tall . . . . . 28. ***H. oblongata*** complex (WA, NT) (for subspecies see **17**)

1. Undersurface of leaves (and usually branches) with ciliolate to entire peltate scales (see Fig. 1I–K, Fig. 2C, D)

40. Leaf margins ± flat or recurved; distal part of outer calyx lobes ± appressed, usually with unilaterally enlarged marginal cilia

41. Calyx with brownish cilia; leaf axils with few brown hairs especially near flowers

42. Flowers single, leaf-opposed along branches, with peduncle (12.3–) 14.5–34.2 mm long . . . . . 12. ***H. guttata*** (NT)

42: Flowers in clusters or rarely single, in terminal position on branches, with peduncle (0–) 1.5–6.0 (–8.8) mm long . . . . . 13. ***H. echiifolia*** complex (WA, NT, Qld) (for subspecies see **Key I**, lead **14**)

41: Calyx with pale hairs along margins; leaf axils without brown hairs

43. Leaf margins recurved to revolute; spreading shrublets

44. Anthers 10–12, each 2.5–3.5 mm long; peduncle (9.4–) 12–19 (–24.3) mm long . . . . . 40. ***H. stirlingii*** (Qld)

44: Anthers 20–30, each 0.7–1.3 mm long; peduncle (3.4–) 6–9 (–11.6) mm long . . . . . 39. ***H. stelligera*** (Qld)

43: Leaf margins (blade) ± flat; perennials with decumbent to prostrate branches, rarely erect and then multistemmed

45. Upper leaf surface with a row of scales along the margins and the central vein becoming glabrous . . . . . 48. ***H. pholidota*** (Qld)

45: Upper leaf surface ± evenly covered with scales and/or hairs

46. Upper leaf surface ± evenly covered with hairs . . . . . 28. ***H. orientalis*** (NT)

46: Upper leaf surface ± evenly covered with scales

47. Plants erect-spreading, multistemmed; buds ellipsoidal . . . . . 26. ***H. brevipedunculata*** (WA, NT)

47: Plants with decumbent to prostrate branches; buds spherical to pyriform

48. Pistils 3; buds (4–) 5–6 mm in diameter . . . . . 34. ***H. complanata*** (WA)

49. Middle of upper leaf surface with 22–26 (–32) scales across; with large scales 0.3–0.35 mm in diameter . . . . . 34a. ***H. complanata*** subsp. ***complanata*** (WA)

49: Middle of upper leaf surface with 11–15 scales across; with large scales 0.5–0.7 (–0.9) mm in diameter . . . . . 34b. ***H. complanata*** subsp. ***ampliata*** (WA)

48: Pistils 2; buds 2.5–3.5 (–4) mm in diameter . . . . . 35. ***H. fractiflexa*** (NT)

50. Leaves 1.1–2.2 mm broad; outer calyx lobes 2.2–2.6 mm long . 35d. ***H. fractiflexa*** subsp. ***filicaulis*** (NT)

50: Leaves (2.3–) 3.5–6 (–13.2) mm broad; outer calyx lobes 3.0–4.6 mm long

51. Middle of upper leaf surface with 12–16 (–22) scales across 35a. ***H. fractiflexa*** subsp. ***fractiflexa*** (NT)

51: Middle of upper leaf surface with (22–) 28–34 (–36) scales across

52. Branches without basal short shoots; stamens 24–26 . . . . . 35b. ***H. fractiflexa*** subsp. ***serotina*** (NT)

52: Branches with many basal short shoots; stamens 16–20 (–22) . . . . . 35c. ***H. fractiflexa*** subsp. ***brachyblastis*** (NT)

40: Leaf margins ± incurved; distal part of outer calyx lobes spreading to recurved, with scale-like unilaterally enlarged marginal scales

53. Leaves linear and with 2–7 (–10) scales across the middle of the upper surface

54. Leaves irregularly incurved; upper leaf surface with large and small scales irregularly arranged with (3) 4–7 (–10) scales across the mid-upper leaf surface . . . . . 45. ***H. lepidota*** (WA, NT, Qld)

54: Leaves regularly incurved (furrowed); upper leaf surface with subequal scales in 2 or 3 ± regular longitudinal rows

55. Upper leaf surface with 3 longitudinal rows of scales; leaf apex with mucro up to 0.5 mm long; plants decumbent . . . . . 47. ***H. sulcata*** (NT)

55: Upper leaf surface with 2 longitudinal rows of scales; mucro up to 1.3 mm long; plants multistemmed, erect . . . . . 46. ***H. marrawalina*** (NT)

53: Leaves elliptic to ovate, or if linear-elliptic then > 10 scales/hairs across at the middle of the upper leaf surface

56. Upper leaf surface densely covered with reflexed rosette-like broad-based fascicled hairs

57. Stamens 10–12; low spreading dense shrublet with rigid woody branches . . . . . 49. ***H. brennanii*** (NT)

57: Stamens 18–26; prostrate to decumbent, or erect-spreading sparse shrublets with wiry branches

58. Shrublet prostrate to decumbent; outer calyx lobes (3.2–) 3.5–4.1 (–4.7) mm long; anthers 0.9–1.2 mm long . . . . . 50. ***H. argyrochiton*** (NT)

58: Shrublet sparse erect-spreading; outer calyx lobes 4.4–5.2 mm long; anthers 1.2–1.6 mm long . . . . . 44. ***H. ciliolata*** (NT)

56: Upper leaf surface covered with ciliate and/or entire scales

59. Shrublets to 0.4 m tall, with prostrate to decumbent wiry branches ..... 50. ***H. argyrochiton*** (NT)
59: Shrublets to 1.5 m tall, with woody erect or spreading branches
60. Leaves (0.9–) 2.5–4 (–4.8) mm broad, with acute apex ..... 51. ***H. incurvata*** (NT)
60: Leaves (6.3–) 10–15 (–18.7) mm broad, with obtuse apex ..... 52. ***H. pancerea*** (NT)

Key to species based on vegetative material

Characters of **juvenile** or **coppicing specimens** were not included in this key. If your specimen has a few lobed leaves (except for some species in the *H. alopecota* subgroup) and/or the vestiture of the undersurface is less dense than that on the upper surface (except for species of the *H. orbicularis* subgroup) then it is likely to be juvenile material, which is probably not identifiable in the following (cf. juvenile stages).

Multistemmed plants usually regenerate from a rootstock but since the latter is often not represented on specimens such plants are normally recognised by scale-like leaves and very short internodes between them at the base of the branches.

Peduncles as well as their distal bracts are sometimes used in this key as they are usually retained for a long time after flowering so that they are often found on plants without flowers. Thread-like (filiform) peduncles are usually < 0.4 mm broad and often more than 20 mm long, while thick (robust) peduncles are > 0.5 mm broad and often scarcely longer than 10 mm.

For a definition of the terms **"axillary"** and **terminal** flowers, refer to p. 11.

1. Branches and/or undersurface of leaves with fascicled hairs
2. Undersurface of leaf lamina less hairy to almost similar to upper one
3. Denseness of vestiture on the undersurface of leaves variable and increasing acropetally .....
..... Juvenile leaves (not included in the key)
3: Denseness of vestiture on the undersurface of leaves similar on all leaves
4. Leaf lamina 3–5 times longer than broad ..... 17. ***H. cactifolia*** (NT)
4: Leaf lamina 1–2.5 times longer than broad
5. Leaf lamina oblanceolate; fascicled hairs on adaxial surface of petiole with antrorse bristle-like arms ..... 18. ***H. scopata*** (WA)
5: Leaf lamina ovate, elliptic-ovate or orbicular; fascicled hairs on adaxial surface of the petiole with spreading arms ..... 19. ***H. orbicularis*** (NT)
2: Undersurface of leaf lamina more densely hairy than upper one
6. Fascicled hairs on abaxial surface of the petiole erect-spreading (hirsute)
7. Most leaves < 5.5 mm broad
8. Leaf lamina ± linear, more than 3 times longer than broad
9. Plants multistemmed with slightly woody rootstock
10. Leaf lamina 0.4–2.3 mm broad
11. Arms of fascicled hairs well-developed on branches and leaves ..... 15. ***H. angulata*** (NT)
11: Arms of fascicled hairs short or vestigial on branches and leaves ..... 16. ***H. ligulata*** (NT)
10: Leaf lamina usually > 2.5 mm broad
12. Leaf margins slightly incurved; peduncle filiform ..... 29. ***H. suffrutescens*** (WA)
12: Leaf margins ± recurved; peduncle short and robust ..... 26. ***H. brevipedunculata*** (WA, NT)
9: Plants with one or few stems and without rootstock
13. Leaf margins revolute
14. Upper leaf surface hirsute; peduncle thick ..... 6. ***H. mulligana*** (Qld)
14: Upper leaf surface stubble-like; peduncle thread-like ..... 38. ***H. scabrifolia*** (WA)
13: Leaf margins flat to slightly irregularly recurved
15. Leaf lamina (2.7–) 5–12 (–16.8) mm long ..... 14. ***H. tomentosa*** (NT)
15: Leaf lamina (22–) 25–40 (–53) mm long ..... 25. ***H. mollis*** (WA)
8. Leaf lamina of various shapes other than linear, mainly up to 2.5 times longer than broad
16. Larger fascicled hairs, especially along central vein of the abaxial leaf surface, silky and arms distinctly longer than those of smaller hairs of velutinous tomentum between vein and margins
17. Fascicled hairs on upper leaf surface reflexed, with short arms (puberulous) ..... 3. ***H. heterotricha*** (Qld)
17: Fascicled hairs on upper leaf surface erect-spreading, with some long arms (hirsute) 4. ***H. malacophylla*** (Qld)
16: Larger fascicled hairs, especially along the central vein on abaxial leaf surface, not silky, arms short and scarcely overtopping shorter ones between the vein and margin
18. Usually > 10 lateral veins visible on the undersurface of leaves ..... 2. ***H. melhanioides*** (Qld)
18: (0–) 2, 3 (–5) lateral veins visible on the undersurface of leaves
19. Peduncle thread-like
20. Undersurface of leaves with several lateral veins visible; upper leaf surface with larger and smaller fascicled hairs ..... 24. ***H. tricornis*** (NT)
20: Undersurface of leaves without lateral veins visible; upper leaf surface with subequal fascicled hairs ..... 36. ***H. oligocarpa*** (NT)
19: Peduncle short and robust

21. Lateral veins on lower surface not or incompletely visible; flowers (peduncle) terminal becoming leaf-opposed ..... 27. ***H. oblongata*** R.Br. ex DC. (WA, NT)
22. Upper leaf surface with short-branched, ± appressed hairs (pubescent to stubble-like tomentum) ..... 27a. ***H. oblongata*** subsp. ***oblongata*** (NT)
22: Upper leaf surface with medium-branched spreading to erect-spreading hairs (velutinous tomentum)
23. Petiole 0–0.5 mm long; leaf lamina abruptly constricted basally ..... 27c. ***H. oblongata*** subsp. ***macrophylla*** (NT)
23: Petiole (0–) 0.5–2 (–3.2) mm long; leaf lamina tapering into petiole
24. Peduncle hirsute to velutinous; west of Daly River; anthers 1.25–1.4 mm long ..... 27b. ***H. oblongata*** subsp. ***brevifolia*** (WA, NT)
24: Peduncle with stubble-like overtopped by larger fascicled hairs; east of Daly River; anthers (1.6–) 1.8–2.6 (–3.2) mm long ..... 27d. ***H. oblongata*** subsp. ***megalanthera*** (NT)
21: 2–5 Lateral veins visible on lower surface of leaves; flowers "axillary" ..... 20. ***H. alopecota*** (NT)
7: Most leaves > 6 mm broad
25. Arms of fascicled hairs along the central vein on undersurface of leaves very long, fine and often curved and ± collapsing
26. Arms of fascicled hairs on the upper leaf surface reflexed and /or very short to commonly cactiform ..... 3. ***H. heterotricha*** (Qld)
26: Arms of some fascicled hairs on the upper leaf surface spreading and usually very long, fine and often ± collapsing, rarely cactiform
27. Peduncles (1) 2 (3) per leaf axil ..... 33. ***H. cymosa*** (Qld)
27: Peduncles 1 per leaf axil
28. Leaf lamina oblanceolate, rarely obovate, apex obtuse to cuspidate; Many Peaks Range, S of Gladstone ..... 4. ***H. malacophylla*** (Qld)
28: Leaf lamina elliptic to elliptic-oblong, apex ± acute; coastal dunes ..... 5. ***H. velutina*** (Qld)
25: Arms of fascicled hairs on undersurface of leaves especially on the central vein of leaves ±short, rigid-spreading
29. Shrubs multistemmed, with slightly woody rootstock
30. Leaf margins slightly incurved; peduncle filiform ..... 29. ***H. suffrutescens*** (WA)
30: Leaf margins ± recurved; peduncle short and robust ..... 26. ***H. brevipedunculata*** (WA, NT)
29: Shrubs with one to few stems, without rootstock
31. Shrubs with decumbent or prostrate branches
32. All leaves toothed or rarely lobed
33. Fascicled hairs on the upper leaf surface often with one arm 2–5 times longer than other arms; peduncle filiform ..... 21. ***H. tridentata*** (NT)
33: Fascicled hairs on the upper leaf surface often with one arm slightly longer than others; peduncle short and robust ..... 20. ***H. alopecota*** (NT)
32: Leaves entire except basal regenerating or juvenile leaves
34. Peduncle short and robust ..... 20. ***H. alopecota*** (NT)
34: Peduncle long and filiform
35. Leaf lamina broadly elliptic to almost orbicular, (9.1–) 15–21 (–24.3) mm broad 23. ***H. circularis*** (NT)
35: Leaf lamina elliptic, (4.6–) 5–10 (–13.6) mm broad ..... 24. ***H. tricornis*** (NT)
31: Shrubs with erect-spreading branches
36. Leaf lamina with (8–) 10–19 lateral veins visible on either side of the central vein
37. Upper leaf surface with reflexed and/or appressed hairs; branches with larger erect hairs over much smaller spreading ones ..... 1. ***H. bicarpellata*** (Qld)
37: Upper leaf surface erect-spreading hairs; branches with subequal hairs ..... 2. ***H. melhanioides*** (Qld)
36: Leaf lamina with (0–) 3–5 (–6) lateral veins visible on either side of the central vein
38. Leaves all with toothed, lobed or sinuate margins
39. Leaf lamina toothed towards the apex; peduncle short and robust ..... 20. ***H. alopecota*** (NT)
39: Leaf lamina with lobed or sinuate margins; peduncle long and thread-like ..... 22. ***H. solanifolia*** (NT)
38: Leaf margins entire except for juvenile leaves at base of plant
40. Upper leaf surface with mixture of cactiform and erect-spreading fascicled hairs (long obviously unequal arms); spreading shrublets up to 0.4 m tall ..... 25. ***H. mollis*** (WA)
40: Upper leaf surface with mixture of larger and small spreading fascicled hairs (medium scarcely unequal arms); erect-spreading shrubs 0.8–1.5 m tall ..... 27. ***H. oblongata*** complex (WA, NT) (for subspecies see **22**)
6: Fascicled hairs on abaxial surface of the petiole mostly reflexed (pubescent), rarely short and spreading (tomentose)
41. Shrubs multistemmed with rootstock
42. Leaf margins flat or scarcely and irregularly recurved
43. Leaf apex commonly surmounted by a tuft of hair arms
44. Peduncle (flowers) terminal becoming leaf-opposed, occurring at intervals of 2 or more leaves ..... 26. ***H. brevipedunculata*** (WA, NT)
44: Peduncle (flowers) "axillary", occurring at successive nodes

45. Upper leaf surface with subequal erect-spreading rosette-like fascicled hairs ..... 30. ***H. axillaris*** (WA)
45: Upper leaf surface with unequal spreading rosette-like to cactiform fascicled hairs ..... 29. ***H. suffrutescens*** (WA)
43: Leaf apex ± covered with long and short hairs but not tufted
46. Leaf margins ± recurved; flowers terminal or on obvious lateral short shoots ..... 26. ***H. brevipedunculata*** (WA, NT)
46: Leaf margins flat or slightly and irregularly recurved; flowers "axillary" with or without vestigial short shoots
47. Branches decumbent; bracts linear; stamens unequal ..... 9. ***H. cistifolia*** (NT)
47: Branches usually erect; bracts ovate and often clasping peduncle; stamens subequal ..... 31. ***H. caudice*** (NT, Qld)
42: Leaf margin recurved to revolute
48. Undersurface of leaves with medium sized erect-spreading hairs (hirsute) ..... 10. ***H. incompta*** (NT)
48: Undersurface of leaves with very short spreading hairs (tomentose to puberulous)
49. Leaves broader than 2 mm
50. Undersurface of leaves usually with some lateral and intramarginal vein visible; peduncle "axillary" usually without short shoot visible at the base ..... 9. ***H. cistifolia*** (NT)
50: Undersurface of leaves without lateral, and rarely intramarginal, vein visible; peduncle terminal or if "axillary" then on obvious short shoots at the base ..... 26. ***H. brevipedunculata*** (WA, NT)
49: Leaves rarely broader than 2 mm
51. Upper leaf surface shortly hirsute to velutinous ..... 15. ***H. angulata*** (NT)
51: Upper leaf surface scabrid to stubble-like or hairs ± appressed
52. Larger hairs on central vein and revolute margins ± appressed (scabrid) ..... 11. ***H. scabra*** (NT)
52: Larger hairs on central vein and revolute margin erect-spreading (shortly hirsute) .. 16. ***H. ligulata*** (NT)
41: Shrubs with one to few stems, without rootstock
53. Leaf margins recurved to revolute
54. Undersurface of leaves usually with 6–10 lateral veins visible on each side ..... 32. ***H. rufociliata*** (Qld)
54: Undersurface of leaves with 0–3 lateral veins usually incompletely visible on each side
55. Undersurfaceof leaves densely covered with coarse spreading hairs (hirsute); low spreading shrublet
56. Fascicled hairs on upper leaf surface sparse to scattered and with short to very short arms ..... 7. ***H. araneolifera*** (Qld)
56: Fascicled hairs on upper leaf surface dense to very dense and with long arms ..... 27. ***H. oblongata*** complex (WA, NT) (for subspecies see **22**)
55: Undersurface of leaves sparsely covered and/or very short hairs (tomentose to puberulous); usually erect spreading shrubs
57. Undersurface of leaves sparsely hairy; leaves scarcely discolourous
58. Shrublet with woody base; leaf axils without brown hairs ..... 39. ***H. stelligera*** (Qld)
58: Spindly shrubs, sparsely woody; leaf axils with few brown hairs especially near flowers ..... 12. ***H. guttata*** (NT)
57: Undersurface of leaves densely covered with fine hairs, leaves usually distinctly discolourous or undersurface not visible between revolute margins and central vein
59. Upper leaf surface with sparse hairs, most of them with short arms
60. Undersurface of leaves usually not visible between revolute margins and central vein; slender shrub to 2 m ..... 41. ***H. pilulis*** (NT)
60: Undersurface usually exposed between recurved margins and central vein; much branched spreading shrublet up to 0.6 m tall ..... 38. ***H. scabrifolia*** (WA)
59: Upper leaf surface with dense hairs, with long arms overlapping
61. Shrublet much branched, spreading, up to 0.4 m tall ..... 37. ***H. extrorsa*** (NT)
61: Shrubs little branched, erect-spreading but straggly, up to 1 m tall ..... 42. ***H. malleolacea*** (NT)
53: Leaf margins flat, rarely slightly recurved or incurved
62. Leaf margins incurved
63. Undersurface of leaves with appressed rosette-like broad-based fascicled hairs or rarely with narrow-rimmed ciliate scales ..... 43. ***H. auriculiflora*** (NT)
64. Shrublet with ± erect branches; upper leaf surface with many smaller hairs under larger ones ..... 43a. ***H. auriculiflora*** subsp. ***auriculiflora*** (NT)
64: Shrublet with low spreading branches; upper leaf surface with few smaller hairs under larger ones ..... 43b. ***H. auriculiflora*** subsp. ***minor*** (NT)
63: Undersurface of leaves with more or less, narrow- to broad-rimmed ciliate scales ..... 44. ***H. ciliolata*** (NT)
62. Leaf margins flat, slightly and irregularly recurved
65. Undersurface of leaves mostly with narrow-rimmed ciliate scales ..... 28. ***H. orientalis*** (NT)
65: Undersurface of leaves with larger and smaller rosette-like fascicled hairs
66. Upper leaf surface with fascicled hairs with very short arms

67. Fascicled hairs on undersurface of leaves sparse and subequal to those on upper surface ..... 12. ***H. guttata*** (NT)
67: Fascicled hairs on undersurface of leaves very dense and unlike upper ones with distinct arms ..... 7. ***H. araneolifera*** (Qld)
66: Upper leaf surface with long arms on fascicled hairs ..... 27. ***H. oblongata*** complex (WA, NT) (for subspecies see **22**)
1. Branches and/or undersurface of leaves with ciliate to ± entire scales (i.e. arms of fascicled hairs ± basally connate)
68. Larger scales predominating on abaxial petiole and leaf apex and obviously overtopping margins
69. Fascicled hairs (not scales) present on upper leaf surface
70. Leaves (1.8–) 30–50 (–74.4) mm long; branches compressed and usually winged ..... 44. ***H. ciliolata*** (NT)
70: Leaves (2.3–) 3–9 (–11.8) mm long; branches almost terete except for ridges ..... 51. ***H. incurvata*** (NT)
69: Scales present on upper leaf surface
71. Upper surface of adult leaves bare between rows of scales along the central vein and margins ..... 48. ***H. pholidota*** (Qld)
71: Upper surface of adult leaves ± evenly covered with scales
72. Leaves linear, U-shaped in section; undersurface usually with entire scales
73. Leaves usually irregularly incurved; upper leaf surface with large and small scales irregularly arranged with (3) 4–7 (–10) scales across the mid-upper leaf surface ..... 45. ***H. lepidota*** (WA, NT, Qld)
73: Leaves regularly furrowed; upper leaf surface with subequal scales in 2, 3, ± regular rows
74. Upper leaf surface with 2 rows of scales; terminal point of leaves up to 1.3 mm long; plants multistemmed, erect ..... 46. ***H. marrawalina*** (NT)
74: Upper leaf surface with 3 rows of scales; terminal point of leaves mucronate, plants decumbent ..... 47. ***H. sulcata*** (NT)
72: Leaves elliptic to ovate or obovate, flat becoming V-shaped in section; undersurface usually with ciliate-peltate scales
75. Scales on upper leaf surface often ciliate ..... 51. ***H. incurvata*** (NT)
75: Scales on upper leaf surface usually entire
76. Shrubs with spreading rigid-woody branches, up to 1.5 m tall; leaves (6.3–) 10–15 (–18.7) mm broad ..... 52. ***H. pancerea*** (NT)
76: Shrublet with prostrate wiry woody branches, up to 0.2 m tall; leaves (3.8–) 4.5–7.0 (–11.4) mm broad ..... 50. ***H. argyrochiton*** (NT)
68: Smaller scales predominate on petiole and leaf apex and rarely overtopping margins
77. Leaf axils with a tuft (rarely one) of brown hairs on nodes below inflorescence
78. Leaf lamina linear to linear-oblanceolate, vestiture scales with cactiform fascicled hairs ..... 12. ***H. guttata*** (NT)
78: Leaf lamina elliptic-lanceolate to oblong, vestiture of mainly scales ..... 13. ***H. echiifolia*** (WA, NT, Qld)
79. Mucro on leaves ending in tuft of simple hairs; leaves above and below with mainly cactiform hairs, rarely scales ..... 13e. ***H. echiifolia*** subsp. ***rotata*** (NT)
79: Mucro on leaves ending mainly in scales/ciliate scales; leaves above and below mainly with scales
80. Scales on leaves sparse above and below
81. Leaves (0.9–) 2–4.5 (–8.3) mm broad; calyx lobes subequal ..... 13b. ***H. echiifolia*** subsp. ***cernua*** (NT)
81: Leaves (2.7–) 4–8 (–13.5) mm broad; calyx lobes unequal, outer ones two-third to half as long as inner ones ..... 13d. ***H. echiifolia*** subsp. ***oligantha*** (NT)
80: Scales dense on leaves above and below
82. Calyx lobes 6.2–7.6 (–8.1) mm long; long anthers 2.5–2.6 mm long ..... 13a. ***H. echiifolia*** subsp. ***echiifolia*** (WA, NT, Qld)
82: Calyx lobes 9–11 (–14) mm long; long anthers 3.5–3.9 mm long .. 13c. ***H. echiifolia*** subsp. ***macrantha*** (NT)
77: Leaf axils (even below flowers) without tuft of brown hairs
83. Leaves with revolute, rarely recurved, margins, linear, linear-oblanceolate
84. Shrublets multistemmed, each with very short internodes at the base ..... 26. ***H. brevipedunculata*** (WA, NT)
84: Shrubs with one or few stems
85. Branches and leaves not densely covered with scales; peduncle (9.4–) 12–19 (–24.3) mm long ..... 40. ***H. stirlingii*** (Qld)
85: Branches and leaves ± densely covered with scales and/or fascicled hairs; peduncle (3.4–) 6–9 (–11.6) mm long ..... 39. ***H. stelligera*** (Qld)
83: Leaves flat, with incurved margins or folded along the central vein
86. Shrublets multistemmed, each of which with very short internodes at the base
87. Leaves ± folded lengthwise but margins recurved ..... 26. ***H. brevipedunculata*** (WA, NT)
87: Leaves flat or margins slightly incurved ..... 8. ***H. eciliata*** (Qld)
86: Shrublets with one to few stems, each of which with distinct internodes at the base
88. Leaf undersurface with ciliolate to entire scales ..... 35. ***H. fractiflexa*** (NT)
89. Leaves 1.1–2.2 mm broad; scales on upper leaf surface up to 0.15 in diameter ..... 35d. ***H. fractiflexa*** subsp. ***filicaulis*** (NT)
89: Leaves (2.3–) 3.5–6 (–13.2) mm broad; scales on upper leaf surface 0.15–0.6 (–0.7) mm in diameter

90. Mid-upper leaf surface with 12–16 (–22) scales across width ... 35a. ***H. fractiflexa*** subsp. ***fractiflexa*** (NT)
90: Mid-upper leaf surface with (22–) 28–34 (–36) scales across width
91. Branches without basal short shoots; stamens 24–26 ..... 35b. ***H. fractiflexa*** subsp. ***serotina*** (NT)
91: Branches with many basal short shoots; stamens 16–20 (–22) ..... 35c. ***H. fractiflexa*** subsp. ***brachyblastis*** (NT)
88: Leaf undersurface densely covered with ciliate scales
92. Leaves elliptic ..... 34. ***H. complanata*** (WA, NT)
93. Mid-upper leaf surface with 22–26 (–32) scales across width; largest scales 0.3–0.35 mm in diameter ..... 34a. ***H. complanata*** subsp. ***complanata*** (WA)
93: Mid-upper leaf surface with 11–15 scales across width; largest scales 0.5–0.7 mm in diameter ..... 34b. ***H. complanata*** subsp. ***ampliata*** (WA)
92: Leaves oblanceolate ..... 28. ***H. orientalis*** (NT)

Key to the species from Western Australia

1. Branches and leaves covered with ciliate to entire scales
2. Pistils 3 or 4; flower buds (4–) 5–6 mm in diameter
3. Shrubs with one to few erect to spreading stems; anthers of different length ..... 13a. ***H. echiifolia*** subsp. ***echiifolia***
3: Shrublets with prostrate to decumbent branches; anthers subequal
4. Scales across the middle of upper leaf surface 22–26, largest scales 0.3–0.35 mm in diameter ..... 34a. ***H. complanata*** subsp. ***complanata***
4: Scales across the middle of the upper surface 11–15, largest scales 0.5–0.7 mm in diameter ..... 34b. ***H. complanata*** subsp. ***ampliata***
2: Pistils 2; flower buds 2.5–3.5 (–4) mm in diameter ..... 45. ***H. lepidota***
1: Branches and leaves covered with rosette-like fascicled hairs
5. Abaxial surface of petiole covered with spreading hairs (hirsute to short-hirsute)
6. Undersurface of leaves less hairy than upper one; leaves rarely longer than 12 mm ..... 18. ***H. scopata***
6: Undersurface of leaves with denser hairs than upper one; leaves usually longer than 15 mm
7. Branches covered with an heterogeneous mixture of very long erect rosette-like and cactiform fascicled hairs, large hairs with obviously unequal arms very long and silky (soft-hirsute) ..... 25. ***H. mollis***
7: Branches covered with a range of erect rosette-like fascicled hairs with larger ones scarcely longer and spreading (velutinous)
8. Shrubs with one to few woody spreading branches; flower buds spherical, 2.5–3 mm in diameter, usually "axillary" ..... 27b. ***H. oblongata*** subsp. ***brevifolia***
8: Shrublets multistemmed, soft-woody; flower buds ellipsoidal, 3.5–5 mm long, usually terminal ..... 26. ***H. brevipedunculata***
5: Abaxial surface of petiole covered with short spreading hairs or reflexed hairs (tomentose to pubescent)
9. Shrubs with one to few stems
10. Peduncle thread-like; leaf lamina < 2.6 mm broad ..... 38. ***H. scabrifolia***
10: Peduncle robust; leaf lamina usually > 3 mm broad ..... 27b. ***H. oblongata*** subsp. ***brevifolia***
9: Shrublets multistemmed
11. Flowers usually "axillary" along the upper branches; flower buds spherical, 2.0–2.5 mm in diameter
12. Anthers 42–50, 0.9–1.3 mm long; upper leaf surface with subequal erect-spreading rosette-like fascicled hairs ..... 30. ***H. axillaris***
12: Anthers 30–36, 1.5–1.7 mm long; upper leaf surface with unequal spreading rosette-like to cactiform fascicled hairs ..... 29. ***H. suffrutescens***
11: Flowers usually single and terminal; flower buds ellipsoidal, 3.5–5 mm long ..... 26. ***H. brevipedunculata***

Key to species from Queensland

1. Flower buds ± spherical with apex of inner calyx lobes rounded and incurved
2. Leaves and branches covered with ciliate to entire scales, rarely also some hairs
3. Leaf margins recurved to revolute
4. Anthers 10–12, each 2.5–3.5 mm long; peduncle (9.4–) 12–19 (–24.3) mm long ..... 40. ***H. stirlingii***
4: Anthers 20–30, each 0.7–1.3 mm long; peduncle (3.4–) 6–9 (–11.6) mm long ..... 39. ***H. stelligera***
3: Leaf margins flat or incurved
5. Leaf margins incurved; leaves < 2.5 mm broad ..... 45. ***H. lepidota***
5: Leaf margins ± flat; leaves usually > 3 mm broad
6. Branches prostrate to scrambling; scales on upper leaf surface in one row along each margin and central vein ..... 48. ***H. pholidota***
6: Branches erect-spreading; scales on upper leaf surface ± evenly spread ..... 13a. ***H. echiifolia*** subsp. ***echiifolia***
2: Leaves and branches covered only with hairs
7. Leaf lamina linear and with recurved to revolute margins ..... 39. ***H. stelligera***
7: Leaf lamina oblanceolate to lanceolate and with flat margins
8. Bracts linear to linear-oblanceolate; pistils 3 ..... 7. ***H. araneolifera***

8: Bracts ovate to broadly ovate; pistils 2
9. Anthers 50–80; upper leaf surface with erect spreading fascicled hairs ..... 33. ***H. cymosa***
9: Anthers 20–45; upper leaf surface with reflexed or appressed fascicled hairs
10. Anthers 36–44; very dense fascicled hairs with very short arms ..... 32. ***H. rufociliata***
10: Anthers 20–30; sparse to moderately dense fascicled hairs with moderate arms; leaf margins sometimes lobed, toothed or sinuate ..... 31. ***H. caudice***
1: Flower buds ± ovoid to ellipsoidal with apex of inner calyx lobes acute to obtuse and ± erect
11. Leaves linear to linear-lanceolate (< 5 mm broad), with revolute margins ..... 6. ***H. mulligana***
11: Leaves lanceolate to ovate or oblanceolate (> 5 mm broad), with flat to slightly recurved margins
12. Abaxial surface of petiole mainly covered with long-spreading hairs (hirsute)
13. Fascicled hair arms on the central vein on the undersurface of leaves all long silky and erect
14. Stamens 50–55; leaf apex obtuse, rarely mucronate; inland mountains (Many Peaks Range) .. 4. ***H. malacophylla***
14: Stamens 34–40, leaf apex usually acute to cuspidate; coastal sand ..... 5. ***H. velutina***
13: Arms of hairs on the central vein on the undersurface of leaves long and short, spreading
15. Stamens 20–26; arms of hairs on central vein on undersurface of leaves mainly short; pistils 2 . 1. ***H. bicarpellata***
15: Stamens 30–60; long arms of hairs on central vein on the undersurface of leaves long and silky; pistils predominantly 3
16. Stamens 37–48; upper leaf surface usually ± grooved along the central and lateral veins ..... 3. ***H. heterotricha***
16: Stamens 50–60; upper leaf surface scarcely grooved along the central vein ..... 2. ***H. melhanioides***
12: Abaxial surface of petiole covered with short or reflexed hairs (pubescent) or scales
17. Leaves and branches covered with ciliate to entire scales ..... 8. ***H. eciliata***
17: Leaves and branches covered with hairs
18. Stamens 20–26; pistils 2 ..... 1. ***H. bicarpellata***
18: Stamens 40–45; pistils 3 ..... 7. ***H. araneolifera***

Hibbertia §*Tomentosae* Benth.

Fl. Austr. 1: 19 (1863)

Vestiture: rarely with simple, but mainly rosette-like broad-based fascicled hairs or ciliate to entire peltate scales developed from them. *Perennials* with branches ± ridged to winged from the centre of the leaf base. *Leaves* mainly flat, sometimes becoming revolute or incurved, with lateral and intramarginal veins often ± visible; juvenile leaves, rarely all leaves with teeth, lobes or sinuate along the margins, and each of these protrusions coinciding with a vein-end. *Flowers* terminal to "axillary" on more or less reduced axillary short shoots; *peduncle* commonly longer to much longer than 5 mm, elongating and recurved when fruiting, with bracts subtending calyx. *Stamens* 6–80, evenly distributed or hardly grouped around the pistils; *filaments* scarcely connate basally; *anthers* ± oblong, abruptly constricted above and below. *Pistils* 2 (–4); ovaries with 2 (–6) ovules, usually basal rarely lateral. *Seeds* broadly obovoid, with cup-like sheath of aril covering the lower third.

Diagnostic features. *Vestiture*: multiangulate rosette-like fascicled hairs to often peltate scales. Branches ± ridged to winged from the centre of the leaf base. *Peduncle* commonly longer than 5 mm, with bracts subtending calyx. *Stamens* arranged around the ovaries. *Pistils* 2 (–4); ovaries hairy to commonly scaly, each usually with 2 (–6) basal (rarely lateral) ovules.

Notes. The §*Tomentosae* are subdivided into the *H. melhanioides* group containing mainly species from Queensland and the *H. tomentosa* group, which is predominantly recorded from the Northern Territory. These two groups are for convenience further subdivided into three and six subgroups, respectively, but this supraspecific classification needs a more detailed evaluation. As Horn (2005, 2009) assessed only five species of the *Hibbertia* §*Tomentosae* in his DNA analyses of the species of *Hibbertia*, no conclusions or support for the above groupings could be gleaned.

1. *Hibbertia melhanioides* group

Vestiture: rosette-like fascicled hairs, rarely peltate scales, on vegetative organs, with marginal stellate cilia on calyx. *Branches* terete to ± ridged from the centre of the leaf base. *Leaves* flat to ± recurved (*H. mulligana*); juvenile leaves with 1–3 teeth or lobes on upper third of each side. *Flowers* terminal to "axillary", with ovoid to ellipsoidal (rarely to pyriform in the *H. echiifolia* subgroup) buds; bracts mainly linear. *Inner calyx lobes* oblanceolate, rarely obovate, acute (rarely up to rounded in the *H. echiifolia* subgroup). *Stamens* usually > 30; *anthers* unequal, (1.3–) 1.5–2.5 (–4.8) mm long. *Style base* with fascicled hairs/scales.

Diagnostic features. Anthers unequal, (1.3–) 1.5–2.5 (–4.8) mm long. *Vestiture*: rosette-like fascicled hairs, rarely peltate scales on vegetative organs, with marginal stellate cilia on calyx. *Style base* with fascicled hairs/scales.

Content. The *H. melhanioides* group is divided into three subgroups (*H. melhanioides* subgroup, *H. scabra* subgroup, *H. echiifolia* subgroup) and contains 13 species.

Notes. Most of the species belong to the *H. melhanioides* subgroup, which is found in northern Queensland, while

three and two species of the *H. scabra* and *H. echiifolia* subgroups, respectively, occur mainly in the Northern Territory.

The 4–6 lateral ovules per ovary in many of the species of the *H. melhanioides* group as compared to 2 basal ovules in most of the *H. tomentosa* group indicates its more primitive status when compared with other hibbertias. Similarly, the ellipsoidal buds and the more or less linear bracts of the *H. melhanioides* group, as commonly found in other parts of the genus, is more primitive than the spherical buds as well as the broad-based, often clasping bracts unique to the *H. tomentosa* group.

Although this group does not have the same diversity of hairs as the *H. tomentosa* group it covers a similar range from mainly rosette-like fascicled hairs to scales in *H. eciliata* and the *H. echiifolia* subgroup. On closer examination the latter scales are smaller and usually of the narrow-rimmed type, which are different to the broad-rimmed scales typical of the *H. lepidota* subgroup in the *H. tomentosa* group.

1.1. *H. melhanioides* subgroup

Vestiture: fine, usually rosette-like fascicled hairs with long unequal spreading arms particularly on the abaxial surface of the petiole, with marginal stellate cilia on the calyx; without tuft of hair in the leaf axils. *Shrubs* with spreading branches terete to ± ridged. *Leaves* usually broad, flat and with scarcely recurved margins; juvenile leaves with 1–3 marginal teeth or lobes on each side. *Flowers* usually "axillary" along branches. *Anthers* (20–) 40–60 (–80), unequal, (1.2–) 1.7–2.8 (–3.1) mm long.

Diagnostic features. Rosette-like fascicled hairs with erect-spreading fine arms distinguish most of the species, except for *H. araneolifera* and *H. eciliata*, which have coarse cactiform fascicled hairs to scales as in the other two subgroups based on *H. scabra* and *H. echiifolia*. The species of those two subgroups have very much elongated long anthers and the *H. echiifolia* subgroup is further distinguished from the subgroup *H. melhanioides* by the tufts of brown hairs in the leaf axils.

Content. Species 1–8. *H. bicarpellata*, *H. melhanioides*, *H. heterotricha*, *H. malacophylla*, *H. velutina*, *H. mulligania*, *H. araneolifera*, *H. eciliata*.

Notes. All eight species are endemic to northern Queensland.

Flowers are "axillary", but in contrast to other groups, there are usually only a few on successive nodes towards the end of most branches. On closer examination often a short stalk, probably indicating aborted flowers, can be observed at other nodes below. This tendency towards terminal clusters of flowers or acrotonous development of the inflorescence is particularly clear in *H. araneolifera* and *H. eciliata*. These species also show a distinct reduction of the length of the arms of the hairs, and in *H. eciliata* there is a tendency towards the formation of scales on vegetative parts of the plants. Although this seems to lead to a similar type of inflorescence in *H. echiifolia*, the latter two species of the *H. melhanioides* subgroup are not considered intermediates, because they do not have the unique tufts of brown hairs in the leaf axils.

1. *Hibbertia bicarpellata* Toelken, *sp. nov.*

A H. melhanioide *20–26 staminibus, 2 carpellis, pilisque longioribus superantibus tomentum velutinum in ramis et vena centrale differt.*

Typus: Queensland, Cook District, Moomin Forest Reserve, *R.Schodde 3281*, 8.viii.1963 (holo.: CANB; iso.: AD; A, BRI, L – n.v.).

Hibbertia velutina auct. non R.Br. ex Benth.: F.M.Bailey, Bot. Bellenden-Ker Exp. fol. edn: 14 (1889), pro parte; oct. edn: 30 (1889), pro parte; Syn. Queensland Fl. 3rd suppl.: 5 (1890), pro parte; Queensland Fl. 1: 14 (1899), pro parte.

Hibbertia melhanioides auct. non F.Muell.: Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007), pro parte.

Shrubs to 1.5 m tall; woody branches ridged or keeled from the centre of the leaf bases, hirsute. *Vestiture* persistent, with spreading rarely reflexed rosette-like, usually broad-based fascicled hairs on branches, leaves and bracts as well as narrow-rimmed peltate scales on the calyx; *on branches* with scattered larger (mainly along ridges) spreading to almost erect rosette-like broad-based fascicled hairs (6–9 usually unequal arms) over dense tomentum of smaller ones with very short spreading arms; *on leaves above* moderately dense, with subequal spreading to reflexed rosette-like broad-based fascicled hairs (8–11 usually subequal arms) with scattered hairs with longer arms particularly towards the margins; *on leaves below* very dense, with spreading fine rosette-like narrow-based fascicled hairs (6–9 subequal arms, often not distinguishable) overtopped by larger suberect to spreading rosette-like broad-based fascicled hairs ((7–) 9–14 often unequal arms) mainly restricted to the veins and revolute margins; *on bracts* above and below dense, with mainly spreading but larger (mainly unequal arms) particularly along the central vein and margins over smaller rosette-like broad-based fascicled hairs; *on outer calyx lobes* outside dense, with small narrow-rimmed, often ciliolate peltate scales on the lower two-third occasionally overtopped by rosette-like broad-based fascicled hairs with short or longer arms and commonly on the margins and towards the apex, inside upper third covered with fine spreading rosette-like, usually narrow-based fascicled hairs becoming denser towards the apex; *on inner calyx lobes* outside dense, with small narrow-rimmed peltate scales surrounded by a ± membranous margin with few small stellate cilia, inside glabrous. *Leaves* without axillary tuft of hairs, *petiole* (0.4–) 0.5–2 (–4.3) mm long; *lamina* elliptic to rarely elliptic-oblong, (10.2–) 20–45 (–72.4) × (5.5–) 8–15 (–23.6) mm, apex obtuse to rounded, rarely cuspidate, base gradually to ± abruptly constricted, flat, entire or rarely with lobe on upper two-

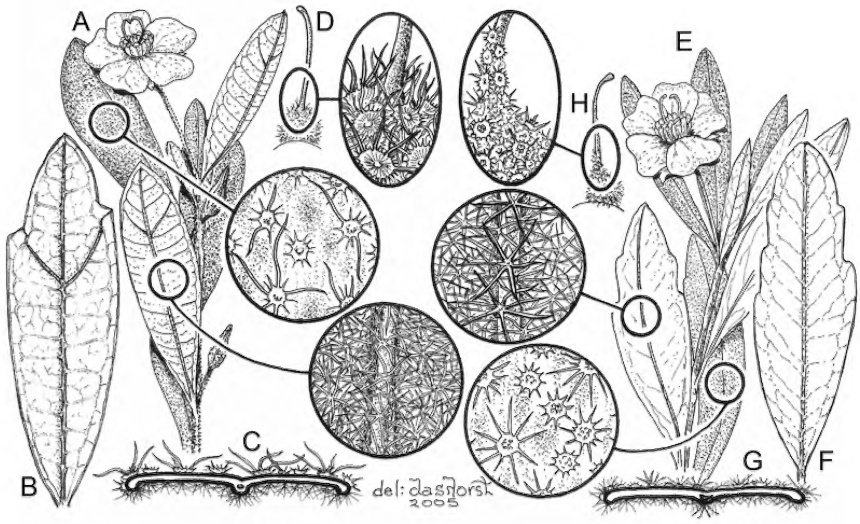


Fig. 3. A–D *H. bicarpellata*: A flowering branch ×1; **B** juvenile leaf from below ×1; **C** transverse section through mid-leaf ×4; **D** style base ×8. **E–H *H. melhanioides*: E** flowering branch ×1; **F** juvenile leaf from below ×1; **G** transverse section through mid-leaf ×3.5; **H** style base ciliate-scaly ×8. — **A**, **C**, **D** *I.R.Telford & J.Wrigley 718*; **B** *M.B.Dochrill 1609*; **E–H** *P.I.Foster 13763*.

third on both sides, above grooved along the central vein and appressed fascicled-pubescent, below with ± revolute margins and with raised central vein as well as visible sinuate intramarginals and connecting laterals (often more than 10), velutinous but ± overtopped by larger hairs, distinctly discolourous; juvenile leaves elliptic-oblanceolate, flat, with one rounded tooth/lobe on upper two-third of each side, finely velutinous. *Flowers* single, "axillary" often without reduced leaves of short shoots, along upper branches, with ellipsoidal beaked buds; *peduncle* stiff, 4.4–7.5 (–12.4) mm long, compressed becoming much broader below the flower; *bracts* strap-like to linear-oblanceolate, (2.4–) 3.5–5 (–7.8) × 0.7–1.3 mm, up to half as long as outer calyx lobes, ridged, erect, ± appressed, tomentose, sometimes not tightly subtending calyx. *Calyx* with lobes unequal; *outer calyx lobes* (3) lanceolate to lanceolate-oblong, (6.4–) 7–10 (–11.7) × 2.8–3.7 mm, distinctly longer than inner ones, beaked to pointed, ridged to keeled abaxially, outside densely but finely peltate-scaly on the lower two-thirds becoming hirsute towards the apex and the margins, inside glabrous on the lower half to two-thirds becoming puberulous to pubescent towards the apex; *inner calyx lobes* (2) broadly obovate, 5.6–6.6 (–7.2) × 4.3–4.8 mm, ± rounded or truncate, faintly ridged, outside densely but finely peltate-scaly surrounded by broad membranous margins with scattered short stellate cilia, inside glabrous. *Petals* oblong-obovate to broadly obovate, 6.8–9.6 mm long, bilobed. *Stamens* 20–26, (staminodes absent), a range of longer and shorter ones, in groups around ovaries; *filaments* broadly filamentous, 1.8–2.1 mm long, scarcely connate basally; *anthers* obloid, 1.6–2.4 mm long, abruptly connate above and below, ± straight. *Pistils* 2; *ovaries* obovoid, each with 4 basal ovules, densely ciliate-scaly also on the style base, with style attached to the apex then curved up- and slightly away from the stem and again inward to place the constricted stigma above the anthers. *Fruiting peduncle* scarcely elongating, little recurved mainly below the fruit. *Seed* obovoid, 3–3.1× 2.5–2.65 mm, dark brown; aril with fleshy attachment enlarged into a cup-shaped membrane (scarcely lobed) covering the lower third of the seeds. *Flowering*: February–September. **Fig. 3A–D.**

Distribution and ecology. Growing on sandy soil often on rhyolite or granite in sclerophyll forest or rarely recorded from vine forest often in association with *Hakea plurinervia* and *Eucalyptus intermedia* or *E. resinifera* on parts of the Atherton Highland, northern Queensland (Co, Nk).

Conservation status. Locally common in several conservation areas.

Diagnostic features. Similar to *H. melhanioides* but distinguished by longer hairs overtopping finer tomentum on branches and central vein on undersurface of leaves, 20–26 stamens and 2 pistils. The long erect silky hairs on the upper and lower leaf surface as well as the longer and greater number of anthers easily distinguish *H. velutina* from *H. bicarpellata*.

Variation. Young leaves are often very much elongated and frequently have an acute apex but become usually rounded later (cf. *G.Crowley 28*, juvenile and *G.Crowley 81*). Leaves and outer calyx lobes are very variable in their size.

Etymology. The material of this species has previously been included in a very variable *H. melhanioides* so

that it seems appropriate to refer in the Latin epithet "bicarpellata", meaning "two carpelled", a very efficient way to distinguish between the two species.

Selection of specimens examined (21 seen)

QUEENSLAND: *M.Bennett QRS 27721*, Wondecla, 20.viii.1938 (QRS); *A.W.Dockrill 1609*, Banksia Forest Reserve, 8.viii.1979 (QRS); *P.K.Endress 4233*, forest reserve, 9.ix.1977 (QRS); *A.Fielding QRS 27719*, Tully Falls, 9.x.1948 (QRS); *Fitzalan MEL 1009302*, Trinity Bay, 1882 (MEL); *H.Flecker QRS 27722*, Wild River, 25.1.1940 (QRS); *B.Gray 6306*, Carrington Falls, 14.ix.1995 (QRS); *N.W.Groves JCU S-4676*, Mt Garnet–Georgetown road, 22.vi.1973 (JCU); *S.Johnson MEL 1009497*, Mulgrave River, 1891 (MEL); *Karsten MEL 1009360*, Bellenden Ker Range, 1881 (MEL); *J.M.Powell 659 & J.A.Armstrong*, Wild River Gorge, 8.ix.1977 (NSW); *L.J.Webb & J.G.Tracey 6220*, N Gap Creek, Bloomfield, viii.1962 (BRI); *J.Wrigley & I.R.Telford CBG 42952*, Wild River, 5.vi.1972 (CANB).

2. *Hibbertia melhanioides* F.Muell.

Fragm. 4: 116 (1864); Syst. Cens. 1: 2 (1882); Sec. Syst. Cens. 1: 2 (1889); Gilg, Nat. Pflanzenfam. edn 1, 3, 6: 117 (1893); Gilg & Werderm., Nat. Pflanzenfam. edn 2, 21: 26 (1925). — *Hibbertia melhanioides* var. *melhanioides*, Domin, Biblioth. Bot. 89: 422 (1928); Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007). — **Typus:** Queensland, North Kennedy district, near Rockingham Bay, *J.Dallachy s.n.*, 11.ii.1864 (lecto. – selected here: MEL 1010262; syn.: MEL 1010263, ?MEL 1551093, ?MEL 1551094A, ?MEL 1551095, ?MEL 1551096).

Hibbertia melhanioides var. *baileyana* Domin, Biblioth. Bot. 89: 422 [976] (1928); Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007). — **Typus:** Queensland, Mount Harold, *F.M.Bailey s.n.*, 1889 (lecto. – selected here: BRI; possible iso.: NSW 121149; syn.: Gipfel der Walsh Pyramide, *J.Danes* 1.1910, PR).

Hibbertia velutina auct. non R.Br. ex Benth.: F.M.Bailey, Bot. Bellenden-Ker Exp. fol. edn: 14 (1889), pro parte; oct. edn: 30 (1889), pro parte; Syn. Queensland Fl. 3rd suppl.: 5 (1890), pro parte; Queensland Fl. 1: 11, 14 (1899), pro parte cf. note below.

Shrubs up to 1 m tall and 2 m in diameter, with several spreading woody branches; branches ridged rarely winged from the centre of the leaf base, velvety to rarely tomentose. *Vestiture* persistent, erect-spreading to reflexed rosette-like broad-based to cactiform fascicled hairs on vegetative parts and with more or less ciliate-peltate scales on the calyx; *on branches* dense, with erect to spreading rosette-like to cactiform broad-based fascicled hairs (5–8 subequal arms); *on leaves above* moderately covered with reflexed rosette-like to cactiform broad-based fascicled hairs (6–10 subequal arms and subequal tubercles); *on leaves below* very dense, with erect-spreading rosette-like broad- to narrow-based fascicled hairs (6–12 subequal arms) but individual hairs often not distinguishable on undersurface; *on bracts* above and below ± dense, with subequal erect-spreading rosette-like usually narrow-based fascicled hairs and without marginal cilia; *on outer calyx* lobes outside very dense, with small narrow-rimmed, often ciliolate peltate scales on the lower two-third ± overtopped by rosette-like broad-based fascicled hairs with short or longer arms and commonly on the margins and towards the apex, inside upper third covered with fine spreading rosette-like, usually broad-based fascicled hairs becoming denser towards the apex (not conspicuous on margin); *on inner calyx lobes* outside dense, with small narrow-rimmed peltate scales surrounded by a ± membranous margin with few to many small stellate cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* (0.4–) 0.8–2 (–3.2) mm long; *lamina* oblong, oblong-oblanceolate to elliptic, (17–) 25–50 (–65.7) × (4–) 10–20 (–26.3) mm, obtuse to rarely truncate but usually with mucronate vein-end, gradually to somewhat abruptly constricted into petiole, entire rarely with up to 1 or 2 teeth on either side along the upper margins, ± flat or with slightly recurved margins, with central veins, normally > 10 or up to 19 laterals connecting to sinuate intramarginal veins usually visible above (± grooved) and below (± raised) but rarely with complete reticulum, above puberulous, rarely pubescent, below tomentose to hirsute, distinctly discolourous; juvenile leaves (regenerating) oblanceolate, with scattered (ca equally dense above and below) subequal rosette-like broad-based fascicled hairs with long spreading arms; from about 6th or 8th leaf on tomentum becoming denser especially below, with 1 or 2 serrations or teeth on each side of leaves until 20–25th leaf on lower branches, flat to slightly recurved margin, with tomentum ± like that of adult leaves. *Flowers* 1 (2), "axillary" often with reduced leaves at the base of the peduncle, along distal parts of branches, with buds ellipsoidal to narrowly ovoid; *peduncle* ± filiform but stiffly spreading, 10.3–26.5 mm long, terete to slightly compressed below flowers; *bracts* linear-elliptic to narrowly spathulate, 4.7–6.3 × 1.2–3.4 mm, ca half to two-third of outer calyx lobes, ridged, pointed rarely obtuse, erect-spreading and often not directly subtending calyx, tomentose. *Calyx* with lobes unequal; *outer calyx lobes* (3) lanceolate to ovate, 9.4–10.2 × 5.1–5.7 mm, longer than inner ones, ± ridged, outside ciliate-scaly overtopped by rosette-like fascicled hairs mainly along the margins (without marginal cilia) but also on the central ridge, inside tomentose on the upper half; *inner calyx lobes* (2), obovate, 7.6–8.3 × 5.6–6.3 mm, obtuse to rounded or emarginate, without ridge, outside ciliolate-scaly surrounded by membranous margin rarely stellate-ciliate, inside glabrous. *Petals* obovate to broadly so, 9.8–13.3 mm long, distinctly bilobed. *Stamens* usually > 50 (–64) (plus up to 8 staminodes), unequal with a range of longer and shorter ones, arranged around the ovaries; *filaments* strap-like, 2.2–3.5 mm long, scarcely connate basally; *anthers* oblong, 1.1–2.4 mm long, abruptly constricted above and below, ± straight. *Pistils* 3; *ovaries* broadly obovoid, each with 3 or 4 basal ovules, densely ciliate-scaly also on the style base, with style attached to the apex then spreading up- and slightly out-, and again inward to place constricted stigmas above the anthers. *Fruiting peduncle* much

elongating and ± recurved. Seeds not seen. *Flowering*: January–September. **Fig. 3E–H.**

Distribution and ecology. Grows on skeletal to sandy soil usually associated with rock outcrops (granite) often along creeks, in open eucalypt forest on mountain slopes along the coast. Recorded from north of Ingham to south of Gordonvale, Northern Queensland (Nk, Co).

Conservation status. Locally common according to notes on collections *D.L.Jones 4429* and *P.I.Forster 13763*.

Diagnostic features. Hibbertia melhanioides is here distinguished from the very similar *H. velutina* and *H. malacophylla* by the reflexed to appressed coarse rosette-like hairs on upper leaf surfaces with many of the arms being rudimentary and only a few more or less elongated. It is easily recognised from other species, such as *H. bicarpellata* and *H. heterotricha* by the short or commonly reflexed hairs on the upper leaf surface and obvious veins and by its velvety tomentum (without longer hairs overtopping it) on branches and the lower surface of leaves, especially that of the central vein.

Variation. One part of the collection *D.L.Jones 4429* has a swollen base suggesting the presence of a rootstock from which the plant resprouts after fires, but this could not be confirmed with other specimens.

Notes. The difference of Domin's two varieties fall well into the range of variation of this species. Even the very few cactiform fascicled hairs on the upper leaf surface of the typical variety are not constant, as four of the J.Dallachy specimens (MEL 1010257, MEL 1010259, MEL 1010261 and NSW 224505) show on the upper leaf surface numbers of cactiform hairs approaching and/or in some cases attaining greater numbers than rosette-like fascicled hairs, as is commonly found in the var. *baileyana*. As a result of this the two varieties are not maintained here, although it is also likely that J. Dallachy collected over a wider geographical range than F. Mueller routinely recorded from "Rockingham Bay". Among these specimens there is one, MEL 1010260, which must be identified as *H. heterotricha* from Hinchinbrook Island. Another one, MEL 1551094, contains a mixture of *H. heterotricha* and *H. melhanioides*.

Bailey included *H. melhanioides* and *H. velutina* in all his treatments of the genus, but in the earlier ones he did not clearly distinguish between the two. Bailey (1889) cited under *H. velutina* specimens from the Mt Bellenden Ker area, which Domin (1928) describes as *H. melhanioides* var. *baileyana*.

A specimen (*W.Persieh MEL 1009459*) with somewhat narrower leaves, but which agrees in all other respects with this variety, was recorded in 1883 from Endeavour River but the species has never been found there again.

Typification. H. melhanioides is based on a J. Dallachy specimen from Rockingham Bay.

A number of specimens are found in F. Mueller's herbarium and they show much variation. Some of them are immediately excluded, because they were collected later than 3 June 1864 (date according to Sinkora 1998) when the species was published so that they could not have been considered for this description. Among the remaining six specimens there are only two that have original collector's labels with a date. MEL 1010262 ("11th February 1864") is selected as lectotype of *H. melhanioides* because, everything being equal, it is a better specimen than MEL 1010263 which is a mixed collection from two different dates: "29 April 1864" and "4 May 1864". The four specimens (MEL 1551093, MEL 1551094A, MEL 1551095, MEL 1551096) without dates are possible syntypes.

As both the two syntypes of *H. melhanioides* var. *baileyana* equally well agree with the protologue the specimen of the name-bringing collector, F.M.Bailey, is here selected as lectotype.

Specimens examined

QUEENSLAND: *B.G.Briggs 2060*, 2 miles S Sunday Creek, ca 10 miles N Ingham, 8.viii.1961 (NSW); *J.Dallachy MEL 1010258*, Rockingham Bay, s.d. (MEL); *J.Dallachy MEL 1010261*, ditto, 8.v.1868 (MEL); *H.Flecker QRS 27684*, Behana Creek, 29.ix.1935 (QRS); *P.I.Forster 13763*, Walshs Pyramid, 29.vii.1993 (AD); *A.K.Irvine 2015*, Walshs Pyramid, 13.vii.1980 (QRS); *R.A.Jago 51*, Walshs Pyramid, iv.1978 (QRS); *D.L.Jones 4429 & M.A.Clements*, S Cardwell, Waterfall Creek Falls, 29.v.1989 (CANB); *E.W.Priest QRS 27682*, between Ingham and Cardwell, 15.viii.1935 (QRS); *R.Le Rossignol QRS 27683*, Walshs Pyramid, 24.viii.1947 (QRS); *I.R.Telford 9252 & G.Butler*, E spur of Bishop Peak, Cardwell Range, 30.1.1983 (CANB).

3. *Hibbertia heterotricha* Toelken, *sp. nov.*

A H. melhanioide *paginis adaxialibus foliorum sulcatis super venae, pilis longioribus et parviorum in venis centralibus lobisque externis calicis pilis longioribus patentibus; a* H. bicarpellata *et* H. velutina *gynoeciis tricarpellatis differt.*

Typus: Queensland, North Kennedy, Mt Spec Range, *C.H.Gittins 493*, v.1962 (holo: BRI).

Hibbertia melhanioides auct. non F.Muell.: Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007), pro parte.

Shrubs rarely up to 2 m tall, with spreading branches; woody branches ridged or keeled in continuation from keeled petiole, hirsute at least when young. *Vestiture* persistent, with spreading to erect, rarely reflexed rosette-like broad-based fascicled hairs on leaves, branches and bracts, and mixed with or only fine narrow-rimmed scales on calyx; *on branches* densely covered with larger usually erect (6–10 unequal arms) mixed with smaller usually spreading rosette-like narrow-based fascicled hairs (3–5 often unequal arms or cactiform); *on leaves above* sparsely to moderately dense, covered with some rosette-like broad-based fascicled hairs (6–9 subequal erect arms) and inbetween more cactiform fascicled hairs of a similar broad base; *on leaves below* with larger erect rosette-like broad-based fascicled hairs

(6–9 subequal to unequal arms) almost dominant on central veins to scattered over the undersurface with very dense smaller spreading narrow-based fascicled hairs (5–8 but individual arms can normally not be distinguished); *on bracts* above moderately dense, with fine short rosette-like fascicled hairs, below dense, with mainly larger erect-spreading rosette-like broad-based fascicled hairs particularly on the margins and the central vein; *on outer calyx lobes* dense, with small narrow-rimmed, often ciliolate peltate scales on the lower two-third ± overtopped by rosette-like broad-based fascicled hairs with short or longer arms and commonly on the margins and towards the apex, inside upper third covered with fine spreading rosette-like, usually narrow-based fascicled hairs becoming denser towards the apex; *on inner calyx lobes* outside dense, with small narrow-rimmed peltate scales surrounded by a ± membranous margin with few small stellate cilia, inside glabrous. *Leaves* without axillary tufts of hairs; *petiole* (1.2–) 2–3.5 (–6.2) mm long; *lamina* oblong-elliptic to elliptic-oblanceolate, rarely elliptic, (24.4–) 45–60 (–83.2) × (4–) 12–20 (–31.6) mm, usually at least 3 times longer than broad, bluntly acute to rounded or cuspidate, ± abruptly constricted into petiole, ± flat, above grooved along the central vein as well as ± along a well developed vein reticulum and sparsely hirsute often becoming puberulous, below with scarcely recurved margins and raised vein reticulum (incl. > 10 laterals and sinuate intramarginals) and ± hirsute particularly on the veins, discolourous; young leaves (coppice) oblong-oblanceolate, with 1–3 serrations (with vein-end at apex) on each side on the upper two-third, flat with margins usually not recurved, with finer hairs and all hairs with arms (no cactiform hairs) on the upper leaf surface. *Flowers* 1 (2), "axillary", with or without rudimentary leaves at base of peduncle, along upper branches, with narrowly ovoid to ellipsoidal buds; *peduncle* stiff, 7.4–15 (–22.4) mm long, compressed below flower; *bracts* linear-oblanceolate to narrowly spathulate, 5.2–7.3 × 0.8–2.2 mm, third to half the length of outer calyx, acute, distinctly ridged, erect and ± appressed, tomentose. *Calyx* with lobes unequal; *outer calyx lobes* (2/3) linear-lanceolate, 9.4–10.5 × 3.6–4.2 mm, distinctly longer than inner ones, beaked rarely acute, distinctly ridged to keeled, outside densely fine-scaly on lower two-third overtopped by ciliate peltate scales becoming hirsute along the margins and the apex, inside glabrous on lower half to two-third then puberulous to pubescent or rarely hirsute at the apex; *inner calyx lobes* (3/2) obovate, 6.5–8.2 × 3.9–4.5 mm, rounded to emarginate, slightly ridged, outside densely fine-scaly surrounded membranous margin with few stellate cilia. *Petals* broadly obovate, 7.7–12.8 mm long, bilobed. *Stamens* 40–48 (plus up to 8 staminodes), unequal but with intermediates, arranged around ovaries; *filaments* broadly filamentous, 2.2–2.8 mm long, scarcely connate basally; *anthers* obloid, 1.2–2.3 mm long, abruptly constricted above and below, ± straight. *Pistils* 2 or 3; *ovaries* broadly obovoid, each with 3 or 4 basal ovules, densely ciliate-scaly and also on the style base, with style attached to the apex then up- and outward and again inward to place the constricted stigmas above the apex of the anthers. *Fruiting peduncle* slightly elongating, scarcely recurved. *Seeds* not seen. *Flowering*: January–August. **Fig. 1H; 2A; 4A–C**.

Distribution and ecology. Grows on slopes in wet sclerophyll forest in the Paluma and Mt Spec ranges as well as Hinchinbrook Island, northern Queensland (Nk).

Conservation status. Unknown.

Diagnostic features. *H. heterotricha* is very similar to *H. melhanioides* but is distinguished by branches and the central vein on the undersurface of leaves being hirsute with a combination of long and short erect hairs; the upper leaf surface is usually variously grooved showing a network of veins and it is covered with some hairs with long suberect arms, but the majority of hairs have no or very short arms (cactiform fascicled hairs); the outer calyx lobes have long spreading to erect hairs on the margins.

It differs from *H. bicarpellata* by having more than thirty stamens and softly silky hairs at least on the undersurface of leaves. *H. malacophylla* has similar soft hairs, but is much more densely hairy especially on the upper surface, so that only the central vein is visible.

Variation. Although *H. heterotricha* is variable it seems significant that in contrast to other species in this complex, young leaves may have up to three serrations on each side of the upper half of the leaf. These leaves have few and finer fully developed rosette-like broad-based fascicled hairs unlike the older leaves which have two distinct types of fascicled hairs above and below. Since some branches with these young leaves also bear flowers e.g. *L.J.Webb & J.G.Tracey 11985* from Hinchinbrook Island, identification of the species can be done by the greater number of serrations on leaves, A specimen, *J.Dallachy MEL 1010260* from the same island, shows the adult leaves and the collector commented "this Hibbertia is different from melhanioides I think it is a much stronger growing plant". On *J.Dallachy MEL 1010261* of *H. melhanioides* from Mt Scott he again distinguished it, saying "the foliage is longer on the plant at Hinchinbrook than on the main land". Although the hairs from plants from Hinchinbrook Island are not quite as fine and silky as those from the Paluma Range, both the above specimens from the island have more than forty stamens and three pistils to distinguish them from *H. bicarpellata.*

Specimens with two or three pistils in each flower have been recorded for this species.

There are usually only two beaked outer calyx lobes and three inner ones with more or less rounded apices and somewhat shorter, but occasionally more or less

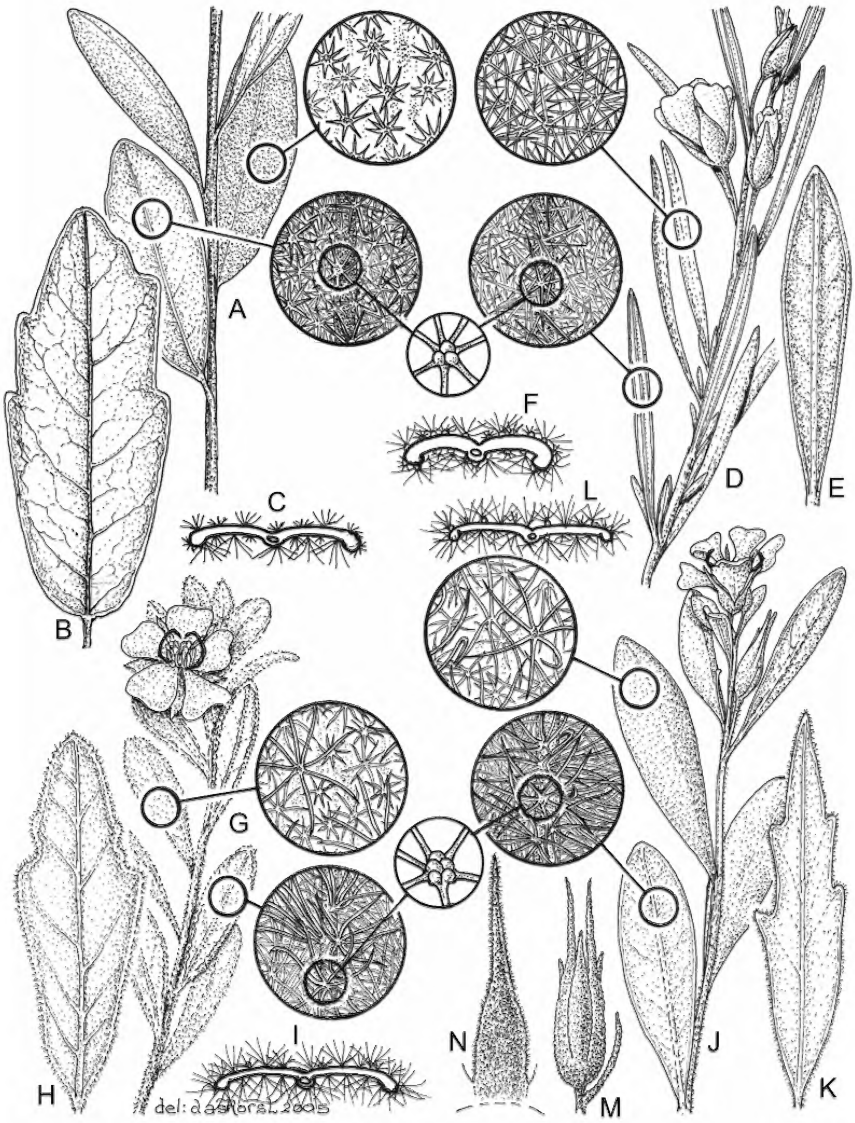


Fig. 4. A–C *H. heterotricha*: **A** branch ×1; **B** juvenile leaf from below ×2; **C** transverse section through mid-leaf ×2. **D–F *H. mulligana***: **D** lowering branch ×1; **E** broad basal leaf ×2; **F** transverse section through mid-leaf ×9. **G–I *H. malacophylla***: **G** flowering branch ×1; **H** juvenile leaf ×2; **I** transverse section through mid-leaf ×3. **J–N *H. velutina***: **J** flowering branch ×1; **K** juvenile leaf ×2; **L** transverse section through mid-leaf ×2; **M** flower bud ×4; **N** bract ×8. — **A**, **C** *W.Jones 3864*; **B** *L.J.Webb & J.G.Tracey 11985*; **D**, **F** *J.R.Clarkson 5307*; **E** *B.David 27*; **G**, **I** *I.R.Telford & S.Donalds 12301*; **H** *P.I.Forster 16221*; **J**, **M**, **N** *A.M.Buchanan 6933*; **K** *N.Michell 3099*.

beaked apices is developed so that it becomes difficult to distinguish between the inner and outer calyx lobes.

Etymology. The epithet "hetero-tricha", [Latinised] Greek for "different haired" refers to the tomentum of the upper and lower leaf surfaces, which have, in contrast to *H. melhanioides,* hairs of distinctly different sizes and shapes.

Specimens examined

QUEENSLAND: *R.L.Correll JCU S-4393a*, Ewen road, 25.v.1966 (JCU); *J.Dallachy MEL 1010260*, Hinchinbrook Island, 9.xi.1867 (MEL); *P.Hind 2677*, Paluma, (NSW); *W.T.Jones 3864*, Hinchinbrook, 23.viiii.1968 (CANB); *S.Melville 30*, 15 km N forestry hut, Bluewater Range, 5.vi.1985 (BRI); *S58*, Paluma Road Saddle, 1.viii.85 (BRI); *G.L.Stebbins A76*, Reedy Creek on road to Paluma, 2.i.1975 (CANB); *G.L.Stebbins A77*, 5.5 km E Paluma, 2.i.1975

(CANB); *I.R.Telford 1954*, Witts Lookout, 24.v.1970 (CANB); *I.R.Telford 1994*, Paluma Road Saddle, 24.v.1970 (CANB); *H.E.Volk 2091*, Wallamans Falls, 16.viii.1961 (BRI); *H.E.Volk* QRS *505702*, Mt Spec, v.1969 (QRS); *C.Warrian 5063*, Hinchinbrook Island, 28.v.1986 (BRI); *L.J.Webb & J.G.Tracey 11985*, Deluge Inlet, Hinchinbrook Island, v.1972 (CANB).

4. *Hibbertia malacophylla* Toelken, *sp. nov.*

Hibbertiae velutinae *similis sed foliis obovatis rotundatis rare obtusis, > 50 staminibus (staminodiis inclusis); a* H. melhanioide *pilis longis sericeis patentibus precipue paginis adaxialibus foliorum differt.*

Typus: Queensland, Port Curtis, ca 2 km WSW Mt Castletower, *I.R.Telford 5471 & R.K.Ellyard*, 2.vi.1977 (holo.: BRI; iso.: NSW; CANB, US – n.v.).

Shrubs up to 0.8 m tall and 1.5 m in diameter, with spreading woody branches little branched; branches ridged from the centre of the leaf base, ± hirsute. *Vestiture* ± persistent, with erect to spreading rosette-like fascicled hairs on vegetative parts and/or scales on the calyx; *on branches* dense, with erect rosette-like narrow-based fascicled hairs (6–12 subequal or unequal arms) often over scattered smaller ones with usually shorter arms; *on leaves above* moderately dense, with fine erect rosette-like broad-based fascicled hairs (5–11 often unequally long arms on mature plants) over smaller with short spreading arms to cactiform; *on leaves below* more dense, with fine erect rosette-like narrow-based fascicled hairs (5–8 subequal rarely unequal arms, but often too dense to assess) over smaller with short spreading arms to rarely cactiform, but sometimes with some larger hairs mainly along the central vein; *on bracts* above and below dense, with fine erect to spreading rosette-like thin- to broad-based fascicled hairs but often shorter than on the branches and leaves; *on outer calyx lobes* outside dense, with fine narrow-rimmed ciliolate-peltate scales overtopped by scattered spreading to reflexed rosette-like broad-based fascicled hairs and larger ciliate-peltate scales as well as spreading fine rosette-like narrow-based fascicled hairs along the margins, inside with erect to spreading fine hairs distally becoming shorter and antrorse, more spreading and fewer downwards and rarely glabrous on lower third; *on inner calyx lobes* outside dense, with small narrow-rimmed scales overtopped by a few scattered larger ciliate-peltate scales and with short fine stellate cilia on the membranous margins. *Leaves* without axillary tuft of hairs; *petiole* (0.8–) 1.5–3.0 (–5.2) mm long; *lamina* elliptic-oblanceolate to rarely -obovate, (7.8–) 20–35 (–44.6) × (2.3–) 8–15 (–18.7) mm, rounded to obtuse, rarely with mucronate vein-end, gradually constricted into petiole, entire to rarely serrate-dentate, with teeth associated with vein-ends, ± flat with slightly recurved margins, above slightly grooved mainly along the central vein and silky-hirsute often becoming pubescent especially in the centre of leaves, below with central vein or if lateral ones then hardly visible because of silky-hirsute tomentum, distinctly discolourous; juvenile leaves not seen but some adult leaves have 2 shallow teeth on either side of the upper leaves. *Flowers* single, "axillary", rarely with rudimentary short shoots, on upper branches, with ovoid to ellipsoidal buds; *penduncle* stiff, 5.8–14.2 mm long, terete or almost so; *bracts* linear-oblanceolate, 3.2–5.6 × 0.8–1.4 mm, ca half or two-thirds of outer calyx, obtuse to rounded, erect, erect-spreading, finely hirsute. *Calyx* with lobes unequal; *outer calyx lobes* (3) ovate, 8.2–8.9 × 4.1–4.6 mm, as long as or scarcely longer than inner ones, beaked to acute with distinct central ridge, erect, outside mainly ciliolate-scaly but with bands of fascicled hairs along the margins and on the apical third, inside tomentose to stubble-like in the the lower half; *inner calyx lobes* (2) broadly obovate, 7.3–8.4 × 6.0–6.6 mm, rounded to occasionally emarginate or mucronate, without ridge, outside densely ciliolate-scaly ending in membranous margins with stellate cilia, inside glabrous. *Petals* broadly obovate, 6.4–10.1 mm long, with two broad lobes often partly overlapping. *Stamens* (46–) 50–55 (usually with up to 12 staminodes) unequal but grading, arranged densely around the pistils; *filaments* almost filamentous, 1.1–1.6 mm long, scarcely connate basally; *anthers* narrowly obloid, 1.4–2.1 mm long, abruptly constricted above and below, slightly more constricted and incurved towards the apex. *Pistils* 2; *ovaries* broadly obovoid to almost spherical, each with 3 or 4 basal ovules, densely ciliolate-scaly also on the style base, with style attached to the apex then horizontally straight out and only broadly curved upward below the constricted stigma at a level below the anthers but above the expanded petals, later straight erect with stigmas just above anthers. *Fruiting peduncle* elongating, slightly recurved. *Seeds* not seen. *Flowering*: February –August. **Fig. 4G–I**.

Distribution and ecology. Grows on sandy soil on granite outcrops in woodland of *Eucalyptus acmenoides* and *E. trachyphloia* on the Many Peaks Range, S of Gladstone, Queensland (Pc).

Conservation status. The species is conserved in Mt Castletower National Park, where it is "very common" according to *P.I.Forster 16221* and *16330*.

Diagnostic features. *Hibbertia malacophylla* is similar to *H. velutina*, both of which are characterised by dense fine spreading hairs, but the former is distinguished by the greater number of stamens and usually smaller obtuse, oblanceolate to obovate leaves with usually invisible lateral veins, or, if apparent, then incomplete. *Hibbertia malacophylla* is found associated with granite outcrops on inland localities, while *H. velutina* has been recorded from sandy soils along the coast.

Hibbertia heterotricha has similar soft hairs but is distinguished from *H. malacophylla* by the leaves, which are abruptly constricted into the petiole and have only a moderately dense tomentum on the upper leaf surface.

Variation. Plants on skeletal soil on granite (e.g. *I.R.Telford 12301*) have smaller elliptic-oblanceolate

leaves, but always with blunt apices, so that they are immediately distinguished from those of *H. velutina*.

The number of staminodes seems to vary from collection to collection. Too little material was available to evaluate distinct patterns.

Etymology. The dense silky hairs are particularly obvious on the leaves to which the epithet "malacophylla", [Latinised] Greek for"soft (to touch)-leaved" refers.

Specimens examined

QUEENSLAND: *S.T.Blake 18794*, near Wallaman Falls, 13.viii.1951 (CANB); *J.Brushe 73 & L.Brushe*, 2 km SW Mt Stanley, 27.vi.1992 (NE); *P.I.Forster 16330*, eastern slopes of Many Peaks Range, 20.ii.1995 (AD, BRI); *I.R.Telford 5471 & R.K.Ellyard*, ca 2 km WSW Mt Castletower, 2.vi.1977 (BRI, NSW); *I.R.Telford 12301 & S.Donaldson*, 3 km W Mt Castletower, 14.viii.1996 (AD, NE).

5. *Hibbertia velutina* R.Br. ex Benth.

Fl. Austr. 1: 30 (1863); F.Muell., Syst. Cens. 1: 2 (1882); F.M.Bailey, Syn. Queensland Fl. 4 (1883); F.Muell., Sec. Syst. Cens. 1: 2 (1889); F.M.Bailey, Bot. Bellenden-Ker Exped. fol. edn: 24; oct. edn: 30 (1889), pro parte, excl. specimens cited; Syn. Queensland Fl 3rd suppl.: 5 (1890), pro parte; Queensland Fl. 1: 14 (1899), pro parte; Compreh. Catal. Queensland Pl. 21 (1913); Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007). — **Typus**: Queensland, Port Clinton, *R.Brown s.n.* [J.J.Bennett 4865], 21.viii.1802 (lecto. – selected here: BM 797274, large right hand specimen; syn.: BM 797274 other specimens on same sheet, BM 551312, K).

Shrubs rarely up to 1 m tall, spreading; woody branches ridged from the centre of the leaf base, but often obscured by silky-hirsute tomentum. *Vestiture* persistent, with fine erect rosette-like fascicled hairs on branches, leaves and bracts and mainly narrow-rimmed scales on the calyx; *on branches* dense, with erect rosette-like narrow-based fascicled hairs (6–9 subequal arms); *on leaves above* moderately dense, with fine erect rosette-like broad-based fascicled hairs (5–9 often unequally long arms on mature plants) over rare smaller with short spreading arms to cactiform; *on leaves below* more dense, with fine erect rosette-like narrow-based fascicled hairs (5–10 subequal arms) but sometimes with some slightly larger hairs mainly in the central vein; *on bracts* above and below dense, with fine erect to spreading rosette-like broad-based fascicled hairs but usually shorter than on the arms and leaves; *on outer calyx lobes* outside dense, with fine narrow-rimmed ciliolate-peltate scales overtopped by scattered spreading rosette-like broad-based fascicled hairs continuing into spreading fine rosette-like narrow-based fascicled hairs along the margins, inside with erect to spreading fine hairs distally becoming shorter, more spreading and fewer downwards and glabrous on lower third lower third; *on inner calyx lobes* outside dense, with small narrow-rimmed scales, more or less of equal size and with short fine stellatate cilia on the membranous margins, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* (2.3–) 3–4 (–4.8) mm long; *lamina* elliptic, elliptic-oblong, (23.4–) 35–60 (–93.3) × (5–) 10–20 (–27.4) mm, acute or bluntly acute and often with mucronate vein-end, gradually tapering into petiole, entire to rarely serrate-dentate with a vein-end at the apex of each tooth, ± flat with slightly recurved margins, above ± grooved along central and some incomplete lateral veins and silky-hirsute, below with raised central and some lateral veins ± obscured by silky-hirsute tomentum, discolourous; juvenile leaves like adult ones but longer, pointed and with 1 rarely 2 serrate rounded teeth (with a vein-end) on either side towards the apex, more sparsely hairy. *Flowers* 1, "axillary", with or without rudimentary leaves at the base of the peduncle, rarely with short shoots visible, towards end of branches, but rarely terminal, with ovoid to ovoid-ellipsoidal bud; *peduncle* stiffly erect, (6.6–) 10–18 (–22.3) mm long, ± terete; *bracts* strap-like to linear-oblanceolate, 3.7–6.2 × 0.3–0.65 mm, usually less than half as long as outer calyx, obtuse rarely acute, with distinct ridge, shortly hirsute to tomentose. *Calyx* with lobes unequal; *outer calyx lobes* (3) lanceolate to linear-lanceolate, 9.2–14.6 × 3.8–4.3 mm, distinctly longer than inner ones, pointed, distinctly ridged along the whole length, outside ciliolate-scaly overtopped by scattered rosette-like broad-based fascicled hairs and hirsute margins, inside hirsute distally becoming pubescent, puberulous to glabrous in the lower third; *inner calyx lobes* (2) obovate, 7.3–8.1 × 5.6–6.4 mm, rounded to slightly emarginate, without ridges, outside densely scaly, with membranous margins usually finely fascicled-ciliate, inside glabrous. *Petals* obovate, 6.8–10.4 mm long, ± bilobed. *Stamens* 30–36 (–40) (without staminodes), unequal but with range, grouped around ovaries; *filaments* coarsely filamentous, 1.3–1.8 mm long, scarcely connate basally; *anthers* narrowly ± obloid, (1.7–) 2–2.8 mm long, ± abruptly constricted and incurved towards the apex. *Pistils* 2; *ovaries* broadly obovoid to almost spherical, each with (3) 4 basal ovules, densely scaly or ciliate-scaly also on style base, style attached to the apex then curved horizontally outward and only upward below the constricted stigma which is placed well outside of the anther column. *Fruiting peduncle* scarcely elongating, slightly recurved. *Seeds* not seen. *Flowering*: May–December. **Fig. 4J–N**.

Distribution and ecology. Grows in sandy soil along the coast, in eucalypt forest or woodland, "coastal sands in tea-tree and wallum-type forest" (*L.J.Webb & J.G.Tracey 3317*) apparently localised in and about Byfield Forest Reserve, Queensland (Pc).

Conservation status. Unknown.

Diagnostic features. While Bailey (1883, 1889, 1890, 1899) used *H. velutina* and *H. melhanioides* without clearly distinguishing them, it is a note by White (1942, p. 201), which expressed doubts as to whether both these species should be retained: "*H. melhanioides* F.Muell. (which is doubtfully distinct from *H. velutina* R.Br.)

…". *Hibbertia velutina* is here distinguished from *H. melhanioides* by its spreading to decumbent habit. The fine fascicled hairs particularly on the upper leaf surface have long erect arms and they cover up most of the venation, which distinguishes it from *H. melhanioides* (with more or less deflexed hairs) although once the tomentum has been removed the two are very similar.

Hibbertia malacophylla is very similar to *H. velutina* but the latter is distinguished by long elliptic, acute to bluntly acute leaves, usually less than 40 stamens, and usually long pointed outer calyx lobes.

Variation. The leaves of *H. velutina*, in common with all the species of *H. melhanioides* subgroup, are often more than twice as long on young fast-growing branches with long internodes and they often have a tooth on either side below the terminal apex, while they are entire and much shorter on senescent branches. These "older" leaves, which fall into the range of sizes of those of *H. malacophylla,* are, however, elliptic and never oblanceolate to obovate with rounded apices as in the latter species.

Typification. Bentham (1863) acknowledged that he had taken up the name *H. velutina* from "R.Br. Herb.", but the very short description does not quote from R. Brown's manuscript description. It also applies equally to any of the syntypes examined, so that the right hand specimen of the sheet (BM 797274) is selected as the lectotype. In the absence of any annotations by the author this specimen is preferred because it is accompanied by an original collector's label. The authorship should be "R.Br. ex Benth."

Specimens examined

QUEENSLAND: *A.M.Buchanan 6933*, Bowenia State Forest, 31.v.1985 (HO); *C.H.Gittins 2547*, ca 24 km from Yeppoon to Byfield, viii.1972 (BRI, NSW); *P.Hind 2648 & J.Forlonge*, Water Park Creek, before Picnic area, 27.viii.1980 (NSW); *N.Michael 3099*, Byfield Road, 16.i.1948 (BRI); *P.Ollerenshaw 1733*, Byfield State Forest, (CANB); *L.Pedley 4156*, 10 km S Byfield, 19.viii.1974 (BRI); *I.R.Telford 842*, Byfield, 24.v.1969 (CANB); *L.J.Webb & J.G.Tracey 3317*, Byfield Forestry Reserve, 2.viii.1957 (CANB).

6. *Hibbertia mulligana* S.T.Reynolds

Austrobaileya 3(3): 537 (1991); Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007). — **Typus**: Queensland, Cook District, Mt Mulligan, 12.iv.1984, *J.R.Clarkson 5307* (holo.: BRI; iso.: MBA, QRS; BRI, MEL, K, L, MO, NSW, PERTH – n.v.).

Shrubs to 1 m high, erect to spreading, rarely decumbent; branches ridged to keeled from the centre of the leaf base, hirsute. *Vestiture* persistent, with erect to spreading rosette-like often narrow-based fascicled hairs on vegetative parts and more or less mixed with ciliate narrow-rimmed scales on the calyx; *on branches* dense, with few to many larger erect rosette-like broad-based fascicled hairs (5–8 usually subequal arms, or up to 14 usually unequal arms) mainly along the ridges over smaller spreading rosette-like broad-based fascicled hairs (7–12 often unequal arms, some of which are very short but usually not cactiform); *on leaves above* moderately dense, with mainly larger erect to spreading rosette-like broad-based fascicled hairs (7–12 subequal arms, or unequal arms on the flanks of the recurved margins) over few interspersed smaller often reflexed rosette-like broad-based fascicled hairs (6–10 often unequal, but usually very short arms, sometimes cactiform); *on leaves below* dense, with mainly larger erect to spreading rosette-like broad-based fascicled hairs over few interspersed smaller ones becoming cactiform along the recurved margins and central vein (± like above) over very dense fine spreading fascicled hairs (individual hairs not visible) on the undersurface; *on bracts* above and below dense, mainly with larger spreading rosette-like broad-based fascicled hairs interspersed with few short-branched smaller ones; *on outer calyx lobes* outside usually very dense, with narrow-rimmed ciliolate scales overtopped by ± large deflexed rosette-like broad-based fascicled hairs scattered over the surface but more common along the central ridge and margins, inside ± dense, with large spreading rosette-like broad-based fascicled hairs becoming smaller and sparser towards the lower third; *on inner calyx lobes* dense, with narrow-rimmed ciliolate scales overtopped by a few ciliate scales mainly along the central ridge and fine narrow-based stellate cilia along the membranous margins, inside with few antrorse fascicled hairs along upper third. *Leaves* without axillary tuft of hairs; *petiole* 0.4–1.8 mm long, indistinct; *lamina* linear to linear-oblanceolate, (12–) 20–28 (–35.6) × 2.2–5.3 (–5.7) mm, bluntly acute to obtuse, slightly and very gradually constricted into petiole, entire, with revolute margins, above grooved along central vein and hirsute to pubescent, below raised central vein (no others usually visible) hirsute like revolute margins and tomentose undersurface, discolourous, juvenile leaves not seen. *Flowers* 1, "axillary", often with rudimentary leaves at base of peduncle, with ovoid buds; *peduncle* firm, 8–16 mm long, terete to slightly ridged; *bracts* strap-like, linear-oblanceolate, 4.9–6.2 × 0.45–0.9 mm, ca half to two-third as long as out calyx, bluntly acute to obtuse, erect, hirsute to pubescent above. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate, 8.6–9.4 × 3.8–5.2 mm, distinctly longer than inner ones, obviously ridged, acute to pointed, outside densely ciliolate-scaly and hirsute along ridge and margins, inside sparsely tomentose on upper half to two-third; *inner calyx lobes* (3) ovate to broadly obovate, 6.4–7.8 × 5.4–6.1 mm, obtuse to rounded, ± ridged, outside finely ciliolate-scaly overtopped by ciliate scales or reflexed fascicled hairs scattered but mainly along the central ridge and towards the apex, with or incomplete marginal membrane and some stellate cilia, inside puberulous to glabrous. *Petals* broadly obovate, 7.1–11.4 mm long, bilobed with lobes often overlapping. *Stamens* 66–74 (with up to 12 filiform staminodes), unequal but

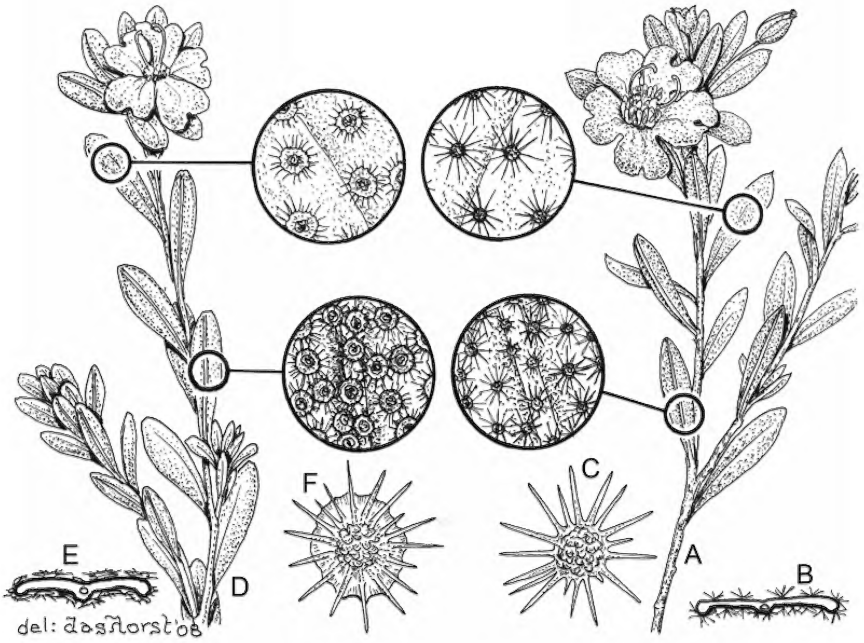


Fig. 5. A–C *H. araneolifera*: a flowering branch ×1; **B** transverse section through mid-leaf ×4; **C** rosette-like fascicled hair abaxial leaf surface ×600. **D–F**, ***H. eciliata*: D** flowering branch ×1; **E** transverse section through mid-leaf ×4; **F** ciliate-peltate scale on abaxial leaf surface ×600. — **A–C** *S.T.Blake 23415*; **D–F** *J.R.Clarkson 8633 & V.J.Neldner.*

grading, around the ovaries; *filaments* ± filiform, 1.5–1.7 mm long, scarcely connate basally; *anthers* obloid, 1.1–1.7 mm long, abruptly constricted above and below, straight to slightly curved inward. *Pistils* 3 or 4; *ovaries* broadly obovoid, each with 3 or 4 basal ovules, densely ciliate-scaly but few on style base with fascicled hairs, with style attached to the inner apex then curved out- and upwards and again inwards to place the constricted stigma above the anthers. *Fruiting peduncle* not seen. *Seeds* not seen. *Flowering*: April. **Fig. 4D–F**.

Distribution and ecology. Grows on sandy slopes with sandstone outcrops in open eucalypt forest with shrubby understorey near Laura and on Mt Mulligan, northern Queensland (Co).

Conservation status. "Very common in places" (*J.R. Clarkson 5307*).

Diagnostic features. The dense shaggy tomentum on leaves and branches and more than 60 stamens easily distinguish this species from *H. stelligera,* a species with similar linear leaves.

Variation. The leaves are commonly linear-elliptic but occasionally they are linear-oblanceolate. Usually lateral veins are not visible on the undersurface of the leaves irrespective of the amount of recurving of the margins. They were, however, observed in one specimen (*B.David 27*), which has relatively short and broader leaves.

Specimens examined

QUEENSLAND: *J.R.Clarkson 5810*, Mt Mulligan, 26.iv.1985 (PERTH, QRS); *B.David 27,* Mt Mulligan, 4.v.1994 (BRI).

7. *Hibbertia araneolifera* Toelken, *sp. nov.*

A H. melhanioide *foliis paucioribus, pilis fasciculatis basibus brevioribus in paginis adaxiallibus foliorum lobisque externis calicis vix porcatis et squamatis; a* H. rufociliata *foliis brevioribus, bracteis linearibus calicibusque longioribus (> 5.4 mm) differt.*

Typus: Queensland, Cook district, near Isabella Falls, *S.T.Blake 23415*, 20.v.1970 (holo.: CANB; iso.: BRI).

Shrublets 0.2–0.6 m tall, spreading; wiry-woody branches bluntly angular from the centre of the leaf base, tomentose. *Vestiture* persistent, with spreading, rarely reflexed rosette-like broad-based fascicled hairs on leaves and branches but more or less scaly on bracts and calyx; *on branches* dense, with spreading to erect rosette-like broad-based fascicled hairs (6–14 subequal often interspersed with unequally long and then often much longer arms); *on leaves above* ± dense, with subequal reflexed rosette-like very broad-based fascicled hairs (13–16 subequal arms); *on leaves below* very dense, with larger spreading rosette-like broad-based fascicled hairs (like above) mainly on the margins and the central vein and scattered ones (rarely a dominant feature of some leaves on *C.H.Gittens 2194*) on the undersurface overtopping very dense smaller ones so

that their individual arms can usually not be seen; *on bracts* above and below dense, with two types of rosette-like broad-based fascicled hairs similar to the leaves; *on outer calyx lobes* outside very dense, with small ciliolate scales overtopped by scattered larger ciliate scales to reflexed rosette-like broad-based fascicled hairs which often form dense margins, inside densely covered with reflexed rosette-like broad-based fascicled hairs on upper half to third; *on inner calyx lobes* outside dense, with small ciliolate scales or few scattered ciliate scales and narrow-based stellate cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.4–1.5 mm long; *lamina* narrowly elliptic to elliptic-oblanceolate, (3.2–) 8–20 (–31.2) × (2.4–) 3.5–6.5 (–10.1) mm, obtuse to truncate but usually with mucronate vein-end covered with reflexed hairs with short arms, gradually constricted into petiole, entire, flat or with scarcely recurved margins, above slightly grooved along the central vein and ± densely appressed pubescent, below with raised central vein and sometimes the intramarginal ones but rarely parts of lateral veins visible, tomentose, discolourous; juveniles leaves not seen. *Flowers* single, "axillary", usually without parts of short shoots visible, mainly towards the end of branches, with ovoid buds; *peduncle* stiffly erect, 5.2–8.3 (–14.6) mm long, terete; *bracts* linear, linear-oblanceolate, 1.8–3.1 × 0.7–1.1 mm, up to half as long as outer calyx lobes, obtuse to rounded, erect, tomentose. *Calyx* with lobes unequal; *outer calyx lobes* (2/3), lanceolate to ovate, 6.1–6.45 × 3.1–3.4 mm, distinctly longer than inner ones, scarcely ridged towards the apex, outside finely ciliate-scaly overtopped by scattered reflexed rosette-like broad-based fascicled hairs more common on the margins, inside pubescent with rosette-like fascicled hairs; *inner calyx lobes* (3/2) ovate to obovate, 5.4–5.9 × 3.9–4.3 mm, obtuse to rounded, without ridges, outside finely scaly, with or without membranous margins and usually stellate cilia, inside glabrous to pubescent on upper third of outermost lobe. *Petals* obovate, 7.5–9.1 mm long, bilobed. *Stamens* 40–44 (without staminodes), unequal but grading, around the ovaries; *filaments* filiform, 1.3–1.8 mm long, scarcely connate basally; *anthers* narrowly obloid, 1.1–1.65 mm long, abruptly constricted above and below, straight. *Pistils* 3; *ovaries* obovoid, each with 2 basal ovules, densely ciliate-scaly to ± fascicled on style base, with style attached to the apex then curved up- and slightly outwards, then incurved to place the erect constricted stigmas just above the anthers. *Fruiting peduncle* elongating and scarcely recurved. *Seeds* not seen. *Flowering*: May–September. **Fig. 5A–C**.

Distribution and ecology. Grows on stony laterite or sandstone ridges in open mixed or eucalypt forest in northern Queensland (Co).

Conservation status. Locally frequent according to *P.Hind 4591 et al.*

Diagnostic features. The broad-based fascicled hairs with very short reflexed arms on the upper surface of leaves and most of the plants are unusual in the *H. melhanioides* subgroup. It is also superficially similar to *H. rufociliata*, but the latter has usually longer leaves, ovate bracts and a calyx shorter than 5.2 mm. Unusual are also the three pistils in three flowers examined.

Variation. There are usually two broadly lanceolate outer calyx lobes and one shorter ovate one, which is about the same size as the other two inner calyx lobes, but in shape and vestiture it is intermediate between the outer two and the inner two, which are usually obovate with distinct membranous margins. It seem to represent an intermediate stage between flowers from three outer (3/2) to three inner calyx lobes (2/3).

Etymology. The epithet "arane-ol-ifera", Latin, "spider-small-bearing" refers to the large-bodied rosette-like fascicled hairs on the upper surface of the leaves resembling hundreds of young carried on the back of mother spider.

Specimen examined

QUEENSLAND: *C.H.Gittins 2194*, 8 km N Hope Vale Mission on McIvor road, 4.ix.1970 (NSW); *P.Hind 2101 & C.K.Ingram*, 6.4 km past Hope Vale Mission, 18.viii.1977 (NSW); *P.Hind 4591, K.Hill & D. Heally*, 3.7 km E Normanby River crossing on road to Battlecamp, 3.viii.1986 (NSW); *W.Persieh MEL 1009227*, Endeavour River, 1882 (MEL); *J.Wrigley & I.R.Telford CBG 42953*, 24 miles NW Cooktown along road towards Isabella Falls, 18.vi.1972 (CANB).

8. *Hibbertia eciliata* Toelken, *sp. nov.*

A H. caudice *lobis calicis externis longis acutis, bracteis linearibus, antheris longioribus; a* H. melhanioide *ramis, foliis et bracteis plus minusve ciliato-lepidotis differt.*

Typus: Queensland, Cook district, 3 km S Cape Flattery township, *J.R.Clarkson 8633 & V.J.Neldner*, 6.v.1990 (holo.: DNA; iso.: MBA; BRI, L, NSW – n.v.).

Shrub to 0.5 m tall, little branched, erect; branches wiry-woody, ridged from the centre of the leaf base, stubble-like or scaly. *Vestiture* persistent, dense, with ± ciliate-peltate to entire scales on branches, leaves bracts and calyx; *on branches* ± dense, with narrow-rimmed, usually irregularly ciliolate (rarely with a few longer cilia); *on leaves above* moderately dense, with subequal narrow-rimmed ciliate-peltate scales (cilia of varying length with extreme ones on scales on the flanks); *on leaves below* very dense, with ± unequal narrow-rimmed ciliolate-peltate scales overtopped by slightly larger ones with longer cilia; *on bracts* below densely ciliate-peltate, above sparsely so and without cilia on the margins; *on outer calyx lobes* outside very dense, with subequal narrow-rimmed peltate scales overtopped by few larger ones and without marginal cilia, inside moderately dense rosette-like broad-based fascicled hairs (10–18 often unequal arms) mainly on the upper third; *on inner calyx lobes* outside dense, with subequal narrow-rimmed peltate scales becoming smaller towards the membranous margin but without marginal cilia, inside glabrous. *Leaves* without axillary tuft of hairs;

petiole 0.4–1.6 mm long; *lamina* elliptic-oblanceolate to elliptic, (5.6–) 8–18 (–21.6) × (2.5–) 3.5–5.7 (–6.8) mm, rounded, truncate to slightly emarginate, often mucronate, gradually tapering into petiole, flat or with slightly recurved margins, above slightly grooved along the central vein (no other vein visible) and moderately densely ciliate-scaly, below with raised central vein and often some laterals and partial intramarginal veins visible, very densely ciliate-scaly, moderately discolourous; juvenile leaves not seen. *Flowers* single, terminal on main and lateral branches, with buds ± ellipsoidal; *peduncle* short and stout, 4–6.5 mm long, somewhat flattened; *bracts* linear-elliptic, 5.1–5.5 × 1.1–1.4 mm, less than half as long as the outer calyx, acute, with central ridge scarcely visible, below densely ciliate-scaly, above scattered ciliate-scaly. *Calyx* with lobes unequal; *outer calyx lobes* (3) lanceolate, 7.8–8.1 × 3.2–4.4 mm, longer than inner ones, acute with erect apex, scarcely ridged, outside densely scaly and without marginal cilia, inside pubescent on upper third; *inner calyx lobes* (2) ovate to obovate, 6.4–6.8 × 4.6–4.8 mm, obtuse to rounded and hooded, with central ridge hardly visible, outside densely scaly and without marginal cilia, inside glabrous. *Petals* broadly obovate, 7.2–9.8 mm long, deeply bilobed. *Stamens* 50–54 (plus some staminodes), unequal, around the ovaries; *filaments* filiform, 1.6–2.0 mm long, scarcely connate basally; *anthers* obloid, 1.3–1.6 mm, but a few 1.9–2.2 mm long, abruptly constricted above and below, ± straight. *Pistils* 2; *ovaries* obovoid, each with 2–4 basal ovules, densely scaly and extended onto the style base, with styles attached to the dorso-lateral apex then curved up- and outwards and again inwards above the anthers. *Fruiting peduncle* not seen. *Seeds* not seen. *Flowering*: May. **Fig. 5D–F**.

Distribution and ecology. Growing on "low undulating section of the dunefield with white sand stained red by laterite from underlying mantle" (*J.R.Clarkson 8633*) in northern Queensland (Co).

Conservation status. Unknown.

Diagnostic features. *Hibbertia eciliata* superficially resembles *H. caudice* but is easily distinguished by the linear bracts, elipsoidal buds, pointed outer calyx lobes and absence of cilia on calyx. The first three characters indicate that the species has greater affinity to the *H. melhanioides* complex except that the whole plant of *H. eciliata* is more or less covered with ciliate scales.

Variation. Juvenile leaves were not observed but a few leaves on areas of young growth showed slight indentations that could indicate the tridentate apex of the leaves, typical of many of the species of the *H. melhanioides* group.

Etymology. The characteristic, the absence of cilia on the leaves as well as the calyx lobes prompted the choice of epithet "eciliata", Latin, "without cilia".

Specimens examined

Known only from the type collection.

1.2. *H. scabra* subgroup

Vestiture: rosette-like fascicled hairs appressed to spreading, but usually not hirsute on the petiole; without tuft of hair in the leaf axils; with marginal fascicled cilia on the calyx. *Plants* multi-stemmed from woody rootstock, with branches terete to slightly ridged. *Leaves*: margins flat to revolute; juvenile leaves without lobes or teeth. *Flowers* "axillary", with peduncle often longer than leaves, with bracts ± linear. *Anthers* (36–) 40–60, distinctly heterantherous, 1.1–1.6 or 2.1–3.8 (–4.8) mm long.

Diagnostic features. The multi-stemmed habit with a more or less woody rootstock and the very much longer large anthers distinguish this subgroup from the *H. melhanioides* subgroup. The *H. echiifolia* subgroup has also often much longer large anthers, but then it is easily distinguished by the axillary tufts of brown hairs and its shrubby habit.

Content. Species 9–11. *H. cistifolia*, *H. incompta*, *H. scabra*.

Notes. Although some species were occasionally recorded in literature from localities outside the Northern Territory this could not be confirmed by the specimens examined.

9. *Hibbertia cistifolia* R.Br. ex DC.

Syst. Nat. 1: 431 (1817); Prodr. 1: 75 (1824); G.Don, Gen. Hist. 1: 76 (1831); Benth., Fl. Austral. 1: 30 (1863); F.Muell., Syst. Cens. 1: 2 (1882); Sec. Syst. Cens. 1: 2 (1889); Gilg, Nat. Pflanzenfam. 3, 6: 117 (1893); Ewart & Davies, Fl. North. Terr. 193 (1917); Gilg & Werderm., Nat. Pflanzenfam. 2 edn, 21: 26 (1925); Specht in Specht & Mountf., Rec. Amer.-Austral. Sci. Exped. Arnhem Land 3: 260, 383, 400, 464 (1958); Chippend., Proc. Linn. Soc. New South Wales 96: 249 (1972); Harmer, N. Austral. Pl. 1: 46 (1976), pro parte; Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988); K.Brennan, Checklist Alligator Rivers Reg. 45 (1996); R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007. — **Typus**: Northern Territory, Arnhem Land, Inglis Island, *R.Brown s.n.* [J.J.Bennett 4863], 26.ii.1803 (holo.: G-DC; iso.: BM 571230, BM 571231, CANB, K 75659, MEL).

Hibbertia sp. 13 K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996).

Shrublet up to 0.3 m high, multistemmed with prostrate to decumbent wiry branches from woody rootstock; branches ± angled from the centre of the leaf base, pubescent to sparsely hirsute, or ± stubble-like. *Vestiture* persistent, with rosette-like to cactiform broad-based fascicled hairs on vegetative parts and with ± dense mainly peltate scales on calyx; *on branches* moderately dense, with few to many spreading (rarely erect) larger over smaller rosette-like to more often cactiform broad-based fascicled hairs (5–9 subequal to unequally long arms); *on leaves above* sparse to

moderately dense, with few scarcely larger and reflexed over/with smaller reflexed rosette-like fascicled hairs (5–10 subequal rarely unequally long arms); *on leaves below* dense, with ± distinctly larger (12–16 subequal to unequally long spreading arms) over smaller ones (with 7–12 reflexed shorter arms) mainly along the margins and the central vein over a denser layer of smaller and finer reflexed (rarely erect) rosette-like, often narrow-based fascicled hairs (5–8 subequal arms) on the undersurface; *on bracts* above and below dense, with larger reflexed to spreading over smaller reflexed to usually cactiform broad-based fascicled hairs; *on outer calyx lobes* outside dense, with ciliate-peltate to entire scales overtopped by larger reflexed rosette-like broad-based fascicled hairs and/or rarely ciliate-peltate scales mainly along the central ridge and the margins, often overtopping margins and with or without cilia, inside moderately to densely covered with spreading and/or reflexed rosette-like broad-based fascicled hairs at least on the upper half; *inner calyx lobes* outside very dense, with peltate scales occasionally overtopped by ciliate-peltate and/or larger reflexed rosette-like fascicled hairs along the faint central ridge and with spreading narrow-based stellate cilia on the margins, inside sometimes with some rosette-like fascicled hairs on upper third. *Leaves* without axillary tuft of hairs; *petiole* (0–) 0.2–2.4 mm long; *lamina* elliptic to elliptic-oblong to -oblanceolate, rarely linear, (6.3–) 20–40 (–58) × (2.1–) 5.0–12.5 (–21.2) mm, shortly cuspidate or rarely acute, becoming obtuse to rounded, gradually or abruptly tapering into petiole, entire, flat with usually slightly recurved margins, above slightly grooved along the central vein, ± pubescent, below with raised central vein, some secondary veins and lobed inframarginal veins more or less visible, ± densely hirsute to velvety or rarely tomentose, discolourous; juvenile leaves (coppice) entire, flat, usually broadly elliptic, usually broader than leaves above, with fewer reflexed to appressed rosette-like broad-based fascicled hairs on both surfaces and scarcely denser below. *Flowers* single, "axillary", with one to several rudimentary leaves in the leaf axil to terminal on short axillary branches, with buds usually narrowly ellipsoidal with calyx commonly incompletely closing after flowering; *peduncle* wiry, (12.6–) 25–35 (–56) mm long, often longer than subtending leaves, angular or compressed below flower; *bracts* linear, linear-lanceolate, (2.4–) 3–4.5 (–7.4) × 1.3–1.7 mm, acute to obtuse, appressed to spreading, pubescent on both surfaces. *Calyx* with lobes unequal; *outer calyx lobes* (3) narrowly elliptic, (7.1–) 8.5–10.4 (–11.3) × (4.2–) 4.5–5.5 (–6.3) mm, usually longer than inner ones, acute rarely obtuse, without obvious central ridge, outside densely scaly, often overtopped by usually few fascicled hairs and/or ciliate-peltate scales along the centre and margins, with stellate cilia towards the apex, inside fascicled-pubescent on upper half; *inner calyx lobes* (2) oblong, oblong-obovate, (6.2–) 6.4–7.2 (-7.5) × 4.2–4.5 mm, rounded with membranous margins usually not ciliate, outside densely scaly, inside glabrous or with few hairs towards margin. *Petals* usually broadly obovate, (6.8–) 8–15 (–21.6) mm long, deeply bilobed. *Stamens* 40–58 (without staminodes), unequal, arranged around ovaries; *filaments* filiform to strap-like, unequal, smaller 1.5–2.6 mm long, longer ones 3.2–4.3 mm long, scarcely connate basally; *anthers* obloid, of which 36–50 are 1.3–1.6 mm long and ± straight (rarely slightly incurved), and 5–8 are 2.6–3.2 (–3.6) mm long and incurved, abruptly constricted above and below. *Pistils* 2; *ovaries* broadly obovoid, each with 2 basal ovules, densely covered with peltate scales but also on lower part of style, with style attached to dorsal apex and curved up and back then forward and down to place the constricted stigma above the apex of the smaller anthers. *Fruiting peduncle* scarcely elongating, recurved. *Seeds* broadly obovoid, 2.2–2.4 × 2.1–2.2 mm, black; *aril* with fleshy basal attachment expanded into a short and scarcely lobed sheath around the lower quarter of the seed. *Flowering*: December–June. **Fig. 2E; 6H–L**.

Distribution and ecology. Locally common on sandy flats or gravely slopes often associated with *Eucalyptus miniata* woodland in the Northern Territory (A).

Conservation status. Locally common.

Diagnostic features. The characteristic features of *H. cistifolia* are multistemmed aerial parts of the plant, which usually regrow annually from a thick underground rhizome, the long stiff peduncle with short linear bracts and ellipsoidal buds, the presence of a few very much longer anthers and the peltate scales on the lower part of the style. It differs by the combination of these characters from the superficially similar *H. caudice*. The very much denser tomentum on the undersurface of leaves as well as much larger fascicled hairs on the margins distinguish *H. cistifolia* from the latter.

Variation. The rosette-like broad-based fascicled hairs of this species vary considerably in the arrangement of the arms (from reflexed to rarely spreading), as well as by their length: their unequally long arms vary from few to many long ones to all very short as in cactiform fascicled hairs, and occasionally all hairs are of a similar type, but more commonly a mixture of all types of hair variations are encountered on the same plant.

A narrow-leaved form (e.g. *K.G.Brennan 305, J.Russell-Smith 8555*) of *H. cistifolia*, resembling mainly *H. scabra* but also the very similar *H. incompta,* differs by its margins being only slightly recurved and at no stage found to be revolute as in those species. It agrees most closely with *H. cistifolia* especially in producing a similar tomentum on the inside of the outer calyx lobes, quite unlike the other two species in the subgroup. A few specimens (e.g. *M.Lazarides 7880 & 7905*) showed somewhat broader leaves, but as these could not be linked to other characters, no taxonomic rank could be attributed to this form.

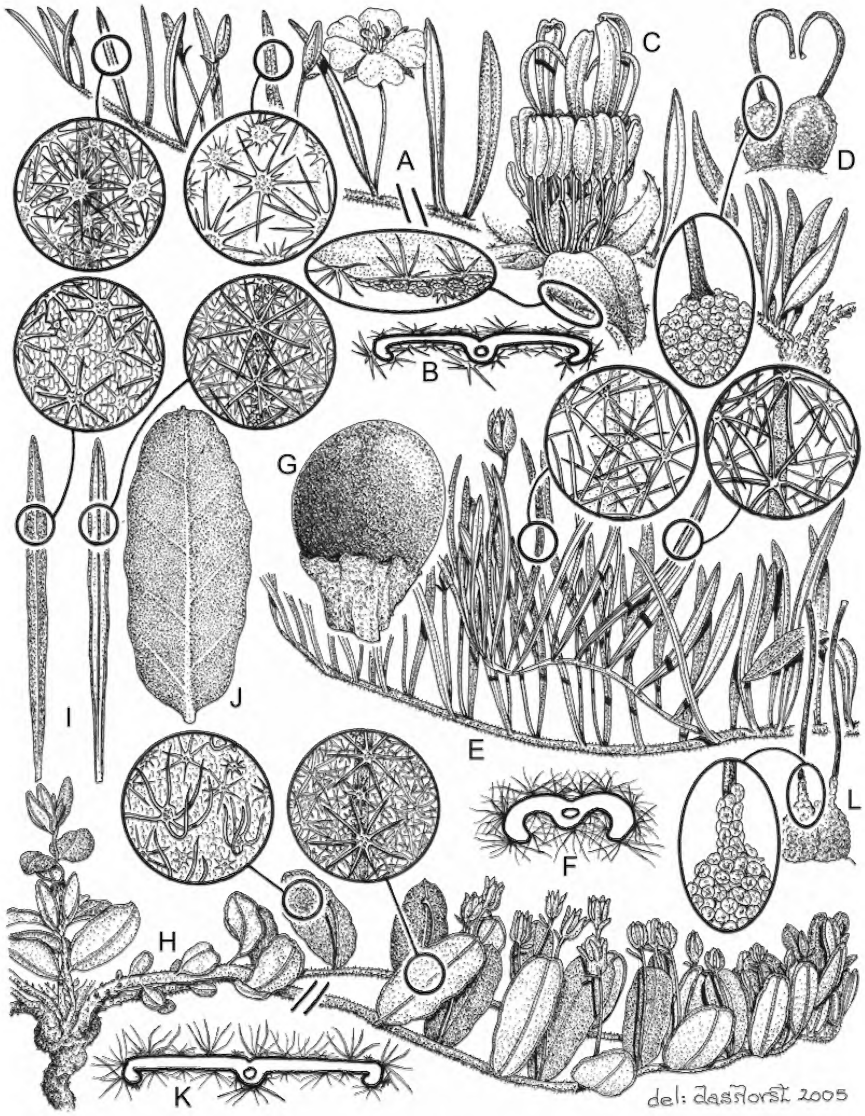


Fig. 6. A–D *H. scabra*: **A** flowering branch with root stock attachment ×1; **B** transverse section through mid-leaf ×10; **C** flower with petals removed, showing recurved styles between larger anthers ×10; **D** style base glabrous ×12. **E–G *H. incompta***: **E** flowering branch ×1; **F** transverse section through mid-leaf ×8; **G**, seed ×10. **H–L *H. cistifolia***: **H** flowering branch with root stock attachment ×1; **I**, **J** extreme leaf variation ×1; **K** transverse section through mid-leaf ×4; **L** style base scaly ×12. — **A–D** *D.E.Murfet 4846*; **E–G** *L.A.Craven & G.M.Wightman 7932*; **H**, **I**, **K**, **L** *K.G.Brennan 4831*; **J** *J.Russell-Smith 8555.*

The sizes of the anthers are variable. Although usually only a few anthers are very much elongated in some plants, a greater number of longer anthers were found in others, but these were then shorter than those of flowers with only a few elongated anthers. While the long anthers were usually of a distinct range, the smaller ones lower down usually show a wide range of variation in size and at times it seemed as if some flowers have anthers of three different size ranges.

Selection of specimens examined (31 seen)

NORTHERN TERRITORY: *K.G.Brennan 305,* 3 km NE Jabiru airstrip, 1.i.1982 (DNA); *K.G.Brennan 4828*, Fire Plot 73, 7.ii.2000 (DNA); *K.G.Brennan 4831*, Fire plot, 25.ii.2000 (DNA); *P.S.Brocklehurst 78*, Angulari Creek, Murgenella Road, 19.vi.1987 (DNA); *J.Egan 893*, Kapalga, 10.i.1993 (DNA); *P.A.Fryxell, L.A.Craven, J.McD.Stewart 4258*, Smith Point, Port Essington, 23.v.1983 CANB); *R.K.Harwood 296*, Jabiluka, 10.ii.1998 (DNA); *R.W.Johnson 4106*, Melville Island, 12.iv.1986 (BRI); *M.Lazarides 7706*, 17 km NNW Oenpelli, 5.ii.1973 (CANB, NSW, NT); *M.Lazarides 7880*,

ca 17 miles SSE of Nourlangie Safari, 27.ii.1973 (DNA); *M.Lazarides 7905*, 4.5 miles NNE Cannon Hill, 28.ii.1973 (BRI, NT); *G.J.Leach 2932 & I.D.Cowie*, Melville Isle, 20.i.1992 (DNA); *G.J.Leach 3933 & C.R.Dunlop*, 10 km from Nguirr on Port Hurd Road, 12.i.1994 (AD); *J.L.McKean B30*, 5 km NW Humpty Doo, 8.xi.1971 (CANB, DNA, NT); *C.R.Michell 3925*, NE corner of Nitmiluk National Park, 11.iv.2002 (DNA); *J.S.Muspratt 358*, Lake Dean, 5.i.1963 (DNA); *B.Rice 3071*, Nabarlek, 17.iv.1979 (DNA); *J.Russell-Smith 2641*, Ramingining, 21.vi.1987 (DNA); *J.Russell-Smith 8555*, Bloomfield Springs, 7.i.1992 (DNA); *J.Z.Weber 9960*, ca 10 km N Murgenella to Gningarg, 28.v.1988 (AD); *G.M.Wightman 1012*, 2 km S Taracumbie Falls, 31.i.1984 (CANB, DNA).

10. *Hibbertia incompta* Toelken, *sp. nov.*

Hibbertiae cistifoliae *et* H. scabrae *similis sed foliorum marginibus manifeste revolutis et foliis ramisque tectis pilis fasciculatis patentissimis differt.*

Typus: Northern Territory, ca 50 km SSW of Jabiru, *L.A.Craven & G.Whitbread 7932*, 24.iii.1981 (holo.: CANB; iso.: DNA, MEL).

Shrublet to 0.3 m high, multistemmed with underground rootstock, weak-stemmed and often becoming prostrate; branches angular, hirsute. *Vestiture* persistent, mainly with large erect-spreading rosette-like broad-based fascicled hairs on branches, leaves and bracts, and with scales overtopped by large fascicled hairs on calyx; *on branches* moderately dense, with usually a sparse cover of slightly larger with smaller erect to spreading rosette-like broad-based fascicled hairs (5–9 usually unequal but some quite long arms); *on leaves above* moderately dense, with scattered larger mainly towards the margins together with smaller spreading rosette-like broad-based fascicled hairs (5–10 often subequal long arms) becoming even smaller along the central groove; *on leaves below* very dense, with scattered very large together with large spreading rosette-like broad-based fascicled hairs on the margins and the central vein overtopping the dense very much finer and smaller larger over smaller usually reflexed rosette-like ± broad-based fascicled hairs on the undersurface; *on bracts* below moderately dense, with mainly larger with smaller spreading rosette-like broad-based fascicled hairs, above sparse top moderately dense, with scattered rosette-like fascicled hairs; *on outer calyx lobes* outside very dense, with scattered coarse larger rosette-like broad-based fascicled hairs (15–24 usually long unequal arms) over smaller reflexed rosette-like hairs, inside on the upper third with more or less appressed antrorse fascicled hairs (4–6 subequal crinkled arms, and usually not rosette-like or rarely broad-based towards the margins; *on inner calyx lobes* outside very dense, with scattered coarse larger rosette-like broad-based fascicled hairs (14–24 usually shorter unequal arms) mainly on the central ridge as well as with scattered ones becoming less frequent towards the margins and some stellate cilia, over smaller reflexed rosette-like broad-based fascicled hairs together with ciliate narrow-rimmed peltate scales mainly towards the base, inside glabrous or rarely with few antrorse fascicled hairs towards the upper margins. *Leaves* without axillary tuft of hairs; *petiole* 0–3 mm long, usually indistinct; *lamina* linear-elliptic, becoming linear when rolled, (22–) 35–70 (–83) × 3–8 mm, flat at first, becoming strongly revolute and 1–2 mm broad on adult leaves, obtuse to rounded or acute as they are rolled, gradually constricted into petiole, entire, above with groove along central vein and spreading-hirsute, below sparsely hirsute with raised central vein and strongly revolute margins usually covering up the finely tomentose undersurface, discolourous; juvenile leaves (coppicing) oblong, entire, flat or with scarcely recurved margins, with scattered rosette-like narrow-based fascicled hairs on both surfaces. *Flowers* 1, "axillary", without vestigial leaves, along the upper part of branches, with ellipsoidal buds usually not fully closing after flowering; *peduncles* stout, 15–25 (–34) mm long, ± flattened; *bracts* linear, linear-triangular, 2.3–2.6 × 0.4–0.6 mm, acute, appressed, almost terete, sparsely hirsute. *Calyx* with lobes unequal; *outer calyx lobes* (2) narrowly elliptic-lanceolate to -ovate, 9.3–10.2 × 4.1–5.2 mm, acute rarely acuminate, with distinct central ridge, outside sparsely hirsute to pubescent, inside appressed pubescent to puberulous on upper third; *inner calyx lobes* (3) oblong-ovate, 9.5–10.4 × 5.2–5.8 mm, obtuse or scarcely rounded, slightly ridged, with membranous margin and usually sparsely stellate-ciliate, outside pubescent with some scales, inside usually glabrous. *Petals* cuneate-obovate, ca 9 mm long, deeply bilobed. *Stamens* 45–60 (without staminodes), unequal, in several bundles around ovaries; *filaments* filiform, 1.3–2.8 mm long (longer ones with long anthers), scarcely connate basally; *anthers* obloid, ca 45 being 1.1–1.5 mm long and scarcely incurved, together with 8–10 being 2.1–3.3 mm long and strongly incurved (mainly among the front and back bundles), all abruptly constricted above and below. *Pistils* 2 or 3; *ovaries* obovoid, each with 4 basal ovules, sparsely scaly, with scarcely scaly style base attached to apex and then curved up- and forward to place the constricted stigma between the long anthers. *Fruiting peduncles* somewhat elongating, scarcely recurved. *Seeds* almost spherical, 3.4–3.6 × 3.1–3.3 mm, brown (almost mature); *aril* with large fleshy attachment and short sheath covering the base of the seed. *Flowering*: March. **Fig. 6E–G**.

Distribution and ecology. Grows in sandy soil on the plains below the Arnhem Land Plateau in *Eucalyptus miniata* woodland, Northern Territory (A).

Conservation status. Rarely recorded and frequency unknown.

Diagnostic features. *Hibbertia incompta* is very similar to *H. cistifolia* and shares with it the presence of a few much longer anthers in among the smaller ones, but is distinguished by its strongly revolute leaf margins and the larger erect fascicled hairs. While the leaves of *H. incompta* are long and flexible, those of *H. scabra* are

short and stiff, rolled as well as covered with appressed hairs.

Variation. The leaves at the base of plants of *H. incompta* are broader and the margins scarcely recurved; the number of these leaves varies from branch to branch. The undersurface of these first juvenile leaves is remarkable in that it has only a few fascicled hairs and each of them usually has fewer arms. The number of fascicled hairs and their arms increase with each new leaf so that adult leaves are developed only after five to twelve leaves, and apparently sooner on side branches.

Etymology. The large wildly spreading hairs of the undersurface of the leaves, when seen under the microscope, give the plant an appearance of being "untrimmed, untended", which was translated into the Latin epithet "incompta".

Specimens examined

NORTHERN TERRITORY: *C.R.Dunlop 6152 & J.A.Taylor*, Jim Jim Creek, 25.iii.1982 (DNA).

11. *H. scabra* R.Br. ex Benth.

Fl. Austral. 1: 31 (1863); F.Muell., Syst. Cens. 1: 2 (1882); Sec. Syst. Cens. 1: 1 (1889); Gilg, Nat. Pflanzenfam. 3, 6: 117 (1893); Ewart & Davies, Fl. North. Terr. 193 (1917); Gilg & Werderm., Nat. Pflanzenfam. 2 edn, 21: 26 (1925); Specht in Specht & Mountf., Rec. Amer.-Austral. Sci. Exped. Arnhem Land 3, 464 (1958); Chippend., Proc. Linn. Soc. NSW 96: 249 (1972); A.S.George & Kenneally, Wild. Res. Bull. West. Austr. 6: 53 (1977), pro parte excl. *A.S.George 14102*: cf. Species insufficiently known; R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007. — **Typus**: Northern Territory, in Arnhem Bay, "Bay 3", *R.Brown s.n.* [J.J.Bennett 4862], 2.iii.1803 (lecto. – selected here: BM 834629, right specimen; syn.: BM 834629, other two branches, K 75661 & sheet 2, MEL 1551097, 1551098, NSW 86601).

Shrublet ca 0.2 m tall, multistemmed with decumbent branches from basal root stock; branches wiry, angular to slightly ridged from the centre of the leaf base when young, ± sparsely pubescent to stubble-like. *Vestiture* persistent, with reflexed rosette-like to cactiform fascicled hairs on branches, leaves and bracts, and peltate scales or rarely ciliate-peltate scales on calyx; *on branches* sparse, with few scattered to dense reflexed rosette-like broad-based fascicled hairs (9–12 short unequal to rarely subequal arms) with scattered sometimes much smaller rosette-like to cactiform broad-based fascicled hairs (6–10 subequal, often very short arms); *on leaves above* sparse to moderately dense, with scattered larger and slightly smaller appressed rosette-like broad-based fascicled hairs (7–16 subequal arms or larger numbers mainly on the flanks of the recurved margins); *on leaves below* dense, with appressed scattered larger with slightly smaller mainly on raised central vein and recurved margins over dense appressed much finer rosette-like almost cactiform broad-based fascicled hairs (8–15 subequal arms); *on bracts* below sparse, with few larger scattered rosette-like to mainly cactiform broad-based fascicled hairs, above glabrescent; *on outer calyx lobes* outside with dense narrow-rimmed peltate scales rarely overtopped by few ciliate-peltate scales and some marginal fascicled hairs towards the apices, inside glabrescent to glabrous; *on inner calyx lobes* outside very dense, with narrow-rimmed peltate scales overtopped by a few ciliate-peltate, often broad-rimmed scales along the central ridge and with glabrous membranous margins rarely with a few scattered stellate cilia; inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0–1.2 mm long, indistinct; *lamina* narrowly elliptic-oblanceolate to usually linear, (6.9–) 9.5–18 (–33.6) × (0.7–) 1–2 (–2.4) mm, acute becoming obtuse to rarely rounded, tapering at base, entire, above slightly grooved along the central vein and sparsely appressed scabrid, below with raised central vein and recurved to revolute margins scabrid and several times denser to tomentose on the undersurface between them, discolourous when undersurface visible; juvenile leaves (coppicing) entire like adult leaves but with scarcely recurved margins and with fewer, or very few hairs on the undersurface. *Flowers* 1, terminal becoming leaf-opposed, on main branches or on short lateral ones forming terminal clusters, with broadly ellipsoidal buds; *peduncle* wiry, 12.8–22.5 (–30.7) mm long, scarcely compressed; *bracts* linear to linear-oblanceolate, 2.4–2.6 × 0.3–0.6 mm, less than half as long as calyx, acute to obtuse, erect, appressed. *Calyx* with lobes unequal; *outer calyx lobes* (3) lanceolate, 5.4–8.5 × 2.2–3.3 mm, acute, more or less ridged, outside ciliate-scaly over scaly with few fascicled hairs towards the margins, inside glabrous; *inner calyx lobes* (2) oblong-obovate, 5.2–8.1 × 2.9–4.7 mm, blunt to rounded, slightly ridged, outside densely scaly with glabrous membranous margins except for few marginal stellate cilia; inside glabrous. *Petals* obovate, c. 5.5–11.6 mm long, bilobed. *Stamens* ca 50 (without staminodes), unequal with ca 5 longer ones, arranged around the ovaries; *filaments* filiform, 2.5–2.8 mm, or 3.1–3.3 mm long with long anthers, scarcely basally connate; *anthers* ± obloid, (1.2–) 1.5–2.5 mm, 3.8-4.8 mm long and curved, abruptly constricted above and below. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly with almost glabrous style base, style attached to the apex then curved up- and backwards then towards the centre with constricted stigmas positioned between the long anthers. *Fruiting peduncle* elongating, scarcely recurved. *Seeds* not seen. *Flowering*: March–April. **Fig. 6A–D**.

Distribution and ecology. Recorded from sandy soil near the edge of the laterite plateau in *Eucalyptus tetrodonta*/*E. miniata*/*E. bleeseri* woodland with sparse *Sorghum* of northern Arnhem Land, Northern Territory (A).

Conservation status. Rare, but occurs in conserved areas.

Diagnostic features. This species is similar to *H. cistifolia*, but *H. scabra* is distinguished by leaves less

than 3 mm broad, style base ± glabrous and absence of hairs on the inside of the outer calyx lobes. The specimens *K.G.Brennan 305* and *J.Russell-Smith 8555,* although having similar narrow leaves to *H. scabra*, are identified as *H. cistifolia* mainly because of their scaly style base and hairy inside of the outer calyx lobes.

Typification. When Bentham (1863) described *H. scabra* based on a R.Brown specimen from Arhem Bay he did not refer to or quote from the latter's description except that he adopted the suggested name. The right specimen on a sheet with the original collector's label (BM 834629) was selected as lectotype, because it agreed with the protologue in the absence of any specimen(s) being annotated by Bentham. The author of the species must be cited as "R.Br. ex Benth."

There are two apparently different specimens of the type collection at Kew, and the depauperate specimens of K 75661 have altogether shorter blunt leaves, so that it appears to be a different plant to that of the second sheet, but the sheet with the lectotype covers the full range of variation, linking the two.

H. scabra was known only from the type collection and most subsequent references in literature are based on the original description. Only as recently as March 2000 the species was rediscovered by I.D.Cowie, and it has since been collected several times.

Specimens examined

NORTHERN TERRITORY: *K.G.Brennan 6818*, Alcan mine lease, Gove, 13.iii.2006 (AD); *I.D.Cowie 8707*, Cadell River, ca 99km S Maningrida, 22.iii.2000 (AD); *I.D.Cowie 8805*, ca 52 km SSE Maningrida, 11.iv.2000 (DNA); *D.E.Murfet 4835*, Djirruwu repeater site, 15.xii.2004 (AD).

1.3. *H. echiifolia* subgroup

Vestiture: coarse cactiform to scale-like trichomes on the whole plant, sparse on leaves and often ± equally dense above and below, with usually brown marginal stellate cilia on the calyx lobes. Tufts of brown hairs in the axils of leaves particularly below the inflorescence/ flowers. *Branches* ridged or winged. *Leaves* flat, with blunt margins, veins scarcely raised with lateral vein, if visible, then ± at right angles; juvenile and coppicing leaves not lobed or toothed. *Flowers* terminal (becoming leaf-opposed) or in terminal clusters; bracts lanceolate to elliptic. *Anthers* 28–45, unequal, 1.2–1.9 or 3.5–5.8 mm long. *Pistils* usually 3, with ovary on ± developed gynophore.

Diagnostic features. The most characteristic feature of the *H. echiifolia* subgroup is the tuft of coarse brown hairs found in the leaf axils particularly those below flowers. The gynoecium is usually tri-pistellate. While *H. guttata* has terminal flowers, which become leaf-opposed, *H. echiifolia* has often a terminal inflorescence.

Content. Species 12–13. *H. guttata*, *H. echiifolia*.

Notes. While *H. guttata* is an extremely localised species, the *H. echiifolia* complex is quite frequently found along the western escarpment of the Arnhem Plateau, but has also been recorded from the Mitchell Plateau in the Kimberley Region of Western Australia, and from near Laura in north-western Queensland.

These two very distinct species have ellipsoidal to pyriform flower buds reminiscent of those of the *H. tomentosa* subgroup but all other characters contradict this placement (see also Notes of *H. scabra* subgroup).

The terminal flowers, for instance in *H. echiifolia* subsp. *oligantha*, form terminal clusters which resemble those of *H. eciliata* (*H. melhanioides* subgroup). This species has also a scaly vestiture, but no tufts of hairs in the axils of leaves, typical of the *H. echiifolia* subgroup, could be found here.

These tufts of hairs in the axils of leaves also reported from several groups in sect. *Pleurandra*, e.g. the *sericea* group (Toelken 2000) are accentuated in the *H. echiifolia* subgroup, because they and the marginal cilia on the bracts and specifically the calyx are more or less tinged rufous. Such coloured cilia are also found in species of the *H. oblongata* subgroup of the §*Tomentosae*, e.g. *H. rufociliata*, but they lack the corresponding axillary tufts of hairs, which are unique to the *H. echiifolia* subgroup within the §*Tomentosae*.

The unusual presence of three or four pistils per flower in the *H. echiifolia* subgroup, which were also often observed in many species of the *H. melhanioides* subgroup and this together with more than two and up to six ovules per ovary indicate a primitive feature. Yet in the *H. echiifolia* subgroup the latter characteristic was often combined with another unusual feature, the elongated receptacle, particularly in fruit. This gynophore is up to 3 mm long in *H. guttata*. A lengthening of the receptacle was also observed in *H. alopecota* but here the gynophore remains fused to the base of the calyx and this is therefore interpreted as a convergent development.

The *H. echiifolia* subgroup is a pair of species with very unusual characteristics and therefore could be interpreted as either a very early branch of development within the *H. melhanioides* subgroup, as accepted here, or represents a third group within the §*Tomentosae*, but this would require more detailed evidence.

12. *Hibbertia guttata* Toelken, *sp. nov.*

A H. echiifolia *foliis linearibus, pedunculis longioribus tomentoque praecipue ramorum et foliorum pilis fasciculatis cactiformibus; a* H. pilulis *foliis planis, pilis paucis in paginis infernis foliorum antherisque longioribus differt.*

Typus: Northern Territory, Arhem Land Plateau, *L.A.Craven 2420*, 27.ii.1973 (holo.: CANB 270790; iso.: BRI, CANB 270789, NT; L – n.v.)

Hibbertia sp. 11 Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988).

Hibbertia sp. 6 K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996).

Hibbertia sp. Magela scabrid (I.D.Cowie 5647) in R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Straggly shrubs to 1 m tall, little branched; branches distinctly angled from the centre of the leaf base, sparsely stubble-like rarely scaly. *Vestiture* persistent, mainly cactiform fascicled hairs on the vegetative parts and with scales on bracts and calyx; *on branches* sparse to rarely moderately dense, with few scattered larger and many smaller cactiform fascicled hairs to ciliolate narrow-rimmed peltate scales; *on leaves above* sparse, with scattered small subequal cactiform fascicled hairs (with 8–12 short arms on leaves of young branches) and/or narrow-rimmed peltate scales which are often more or less sunk into the upper surface; *on leaves below* sparse to rarely moderately dense, with scattered small subequal fascicled hairs and/or narrow-rimmed peltate scales similar in size and number to those on the upper surface; *on bracts* above and below with widely spaced small subequal narrow-rimmed peltate scales; *on outer calyx lobes* outside dense, with scarcely larger over smaller peltate scales and rufous often long stellate cilia, inside glabrous to minutely hairy at the apex; *on inner calyx lobes* outside very dense, with slightly larger over smaller peltate scales and with rufous, often long stellate cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.3–1.0 (–1.5) mm long; *lamina* linear, linear-elliptic or rarely -oblanceolate, (12.4–) 20–35 (–71.8) × 1.9–4.0 (–5.7) mm, obtuse and often mucronate, rarely acute, gradually constricted into the petiole, entire, flat or grooved above along the central vein to slightly folded lengthwise and with straight intramarginal veins often visible, below with central vein slightly raised and straight intramarginal ones very close to the margins (but usually no lateral veins visible between them), above and below sparsely stubble-like or individual hairs more or less sunk, not discolourous; juvenile leaves not seen but those on fast growing branches much larger and entire. *Flowers* single, terminal on long shoots becoming leaf-opposed, with buds ellipsoidal to ellipsoid-obpyrifom; *peduncle* thin at base becoming broader below flower, (12.3–) 14.5–34.2 mm long, slightly ridged; *bracts* linear-triangular, 3.2–5.3 × 0.9–1.6 mm, usually shorter than outer calyx, acute, flat and without central ridge, moderately scaly above and below. *Calyx* with lobes unequal; *outer calyx lobes* (2) elliptic to elliptic-lanceolate, 5.8–8.1 × 3.3–3.8 mm, outermost one often much shorter than the second one, obtuse to rounded, without central ridge, outside usually densely scaly and with some marginal cilia, inside ± glabrous; *inner calyx lobes* (3) oblong to oblong-obovate, 7.9–10.2 × 5.1–6.8 mm, up to twice longer than outer ones, rounded with membranous margin and usually with rufous cilia, outside densely scaly, inside glabrous. *Petals* broadly to narrowly obovate, 9.8–12.3 mm long, deeply bilobed. *Stamens* 28–36 (with few staminodes), unequal, arranged in groups around the ovaries; *filaments* unequal, filiform ones 1.2–1.9 mm long with anthers around ovary, robust ones 3.5–5.2 mm with anthers spreading at level of stigmas, scarcely connate basally; *anthers* obloid, 1.7–2.5 mm long, abruptly constricted towards the apex and base, usually incurved. *Pistils* 3 on gynophore up to 3 mm long when fruiting; *ovaries* broadly ovoid, each with 2 basal ovules, densely scaly also on style base, with style attached to the apex then curved up- and outward and again inward to place the constricted stigmas at the level of the upper anthers. *Fruiting peduncle* elongating, spreading (not recurved). *Seeds* broadly obovoid, 2.9–3.1 × 2.5–2.7 mm, brown to black; *aril* with fleshy attachment expanding into a scarcely lobed sheath covering more than half of the seed. *Flowering*: December–June. **Fig. 7A–C**.

Distribution and ecology. Grows "in sheltered places, usually besides rocks" in sandstone heath on the western Arnhem Land Plateau, Northern Territory (A).

Conservation status. Rare but restricted to conserved area.

Diagnostic features. *Hibbertia guttata* has a similar straggly habit, long straight peduncles and flat linear to linear-elliptic leaves resembling those of *H. malleolacea* (*H. stirlingii* subgroup), but is distinguished by being covered with cactiform fascicled hairs and/or larger small scales, larger ellipsoidal buds and especially by anthers 1.7-2.5 mm long on long spreading filaments. The tomentum is superficially similar to that on *H. pilulis*, but *H. guttata* is distinguished by its flat leaf margins with more or less equally scattered fascicled hairs on the upper and lower leaf surface, and much larger anthers on long filaments.

Variation. All specimens examined had mainly cactiform fascicled hairs grading into small peltate scales and these may be more or less sunken into the upper and/or lower surface of the leaves. Even the very much larger leaves on the main axis show scarcely more pronounced arms on the fascicled hairs. These closely compare to the prominent papillae on the cactiform fascicled hairs. Juvenile leaves have not been seen.

The intramarginal veins are usually well visible very close to, but usually separated by a depression from the scarcely recurved margin. Even in unusually broad leaves (e.g. *K.G.Brennan 261*) they also are characteristically close to the margin, while the lateral veins joining the intramarginal veins to the central vein are normally not visible.

The flowers of *H. guttata* are quite different to those of the very similar *H. malleolacea* and *H. pilulis*. The anthers on long spreading filaments are born well above the ovary while the short anthers are clustered around the ovary similar to those of the latter two species. This arrangement suggests a different pollination syndrome resembling that of *H. echiifolia*, *H. cistifolia*, *H. incompta* and *H. scabra,* except that in *H. guttata* the anthers of the larger stamens are of almost similar size to those of smaller stamens.

Even more unusual is the development of a hard gynophore in the fruiting stage.

Etymology. The few small pale scales are scattered over the whole plant so that it appears to be "apparently sprinkled with dots of oil or resin", Latin, "guttata".

Specimens examined

NORTHERN TERRITORY: *K.G.Brennan 261*, Radon Gorge, 15.xii.1989 (DNA); *I.D.Cowie 5647 & K.G.Brennan*, upper catchment of Magela Creek, 12.iv.1995 (DNA); *J.Forshaw CANB 284068*, Radon Creek, 11.vii.1979 (CANB); *J. & D.L.Russell-Smith 10377*, Magela Creek catchment, 11.iv.1995 (DNA).

13. *Hibbertia echiifolia* R.Br. ex Benth.

Fl Austral. 1: 31 (1863); F.Muell., Syst. Cens. 1: 2 (1882); Sec. Syst. Cens. (1889); Ewart & Davies, Fl. N.Territory 193 (1917); Specht in Specht & Montf., Rec. Amer.-Austral. Sci. Exped. Arnhem Land 3: 464 (1958); J.R.Wheeler, Fl. Kimberley Region 152 (1992), pro parte; R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007. — **Typus**: Northern Territory, "Bay 3 N Coast" [Arnhem Bay], *R.Brown s.n.* [J.J.Bennett 4859], 2/3.iii.1803 (lecto.: – selected here: BM 797276, left branch; isolecto.: BM 797276, second branch, K 75660a, MEL 1551090, pro parte; syn.: Winchelsea Island, *R.Brown s.n.* [J.J.Bennett 4859], 16.1.1803, BM 797275, K 75660b; without precise locality: K, MEL 1551091, NSW 86603, pro parte, see typification).

Shrubs up to 3.5 m tall, few to many-stemmed, with flexible to stiffly woody branches, sometimes with weeping apices; branches winged or ridged downwards from the leaf base, densely scaly, ciliolate-scaly, stubble-like to rarely almost glabrous. *Vestiture* persistent, with peltate to rarely ciliate-peltate narrow-rimmed scales or cactiform fascicled hairs (large and small scarcely differing except on calyx) on the whole plant; *on branches* usually moderately dense, with narrow to broad peltate scales, rarely restricted to nodes; *on leaves above* and *below* subequal, ± sparse, with very small scales or fascicled hairs ± equally dense and/or recessed on both surfaces, and scales not or scarcely overtopping margins; *on bracts* similar to leaves except sometimes with rufous stellate cilia; *on calyx lobes* outside with much larger scales but becoming smaller towards the margins and with rufous simple or rarely stellate cilia, inside glabrous. *Leaves* with axillary tufts of hairs mainly below flowers; *petiole* 0–1 mm long, indistinct; *lamina* elliptic, elliptic-lanceolate or oblong, 4.8–73.1 × 0.9–17.2 mm, cuspidate to mucronate or rarely acute, usually becoming more or less rounded, gradually or abruptly tapering into petiole, entire, flat and with blunt margins, above scarcely grooved along central vein and scaly and/or ± stubble-like, below with central vein more or less raised and usually with somewhat raised straight intramarginals while lateral veins are ca at right angles between the former two but rarely completely visible, moderately to sparsely scaly and/or stubble-like (vestiture usually about equally dense on both surfaces), faintly to more distinctly discolourous; juvenile leaves not seen. *Flowers* terminal, single becoming leaf-opposed, or often in clusters of 3 (–5), from several nodes, with buds spherical becoming pyriform or ellipsoidal becoming cylindro-pyriform; *peduncle* robust, 0–23 mm long, often subtended by a short shoot with 3 scales, angular; *bract* lanceolate-elliptic, 3.5–10.6 × 1.6–3.2 mm, acute to obtuse, flat and with slightly raised central vein below, ± densely scaly on both surfaces and with often rufous marginal cilia. *Calyx* with lobes similar or unequal, *outer calyx lobes* (2) oblong-elliptic to broadly elliptic, 2.8–13.8 × (2.2–) 3–5.5 (–6.6) mm, as long as to up to half as long as inner ones, rounded or rarely obtuse apex, flat, with scarcely membranous margins with rufous to pale brown cilia, outside densely scaly, inside glabrous; *inner calyx lobes* (3) oblong-obovate, 4.6–14 × (3.2–) 4–6 (–7.2) mm, rounded, with scarcely membranous margins with rufous to pale brown cilia, outside densely scaly, inside glabrous. *Petals* obovate, rarely cuneate-obovate, 7.3–16.7 mm, bilobed. *Stamens* 29–45 (without staminodes), unequal, arranged in groups around the ovaries; *filaments* filiform, 1.2–3.5 mm long, of two length, scarcely basally connate; *anthers* slender obloid, usually of two different length, 1.3–3.8 mm long, ± abruptly constricted into filament but often with pointed apex. *Pistils* 3, rarely 4; *ovaries* ovoid, with 2 ovules, densely scaly also on style bases, with style attached to apex then curved out- and upward and then again slightly inward to place the constricted stigma in between the larger anthers. *Fruiting peduncle* scarcely elongating, slightly recurved. *Seeds* broadly obovoid, 2.3–2.8 × 2.2–2.8 mm, brown to black; *aril* with fleshy basal attachment extending into a cup-shaped sheath (scarcely lobed) covering the lower two-third of the seed.

Diagnostic features. Hibbertia echiifolia and *H. guttata* are unique in the §*Tomentosae* because of their normally tri-pistillate gynoecium, a large and well developed gynophore in the fruiting stage, and tufts of brown hairs in the axils of the leaves below flowers, reminiscent of those observed in several other groups of the genus including the *H. sericea* complex (Toelken 2000). The two species are, however, easily distinguished, as *H. guttata* has more or less linear leaves and especially smaller flowers on long spreading peduncles similar to those of the *H. stirlingii* subgroup.

Notes. This very variable species has a very wide distribution from Western Australia to Queensland and was divided into five subspecies, but four of these show their greatest diversity, similar to the §*Tomentosae* as a whole, along the western escarpment of the Arnhem Land Plateau. The flowers are solitary and terminal in both subspecies *macrantha* and *cernua*; these two subspecies are also characterised by ellipsoidal flower buds, which are more commonly found on species from Queensland. In subsp. *macrantha* there are at least three fully developed leaves (nodes) before the next flower (e.g. *P.Martensz & R.Schodde AE574*), while successive flowers were observed at much larger intervals in subsp. *cernua*.

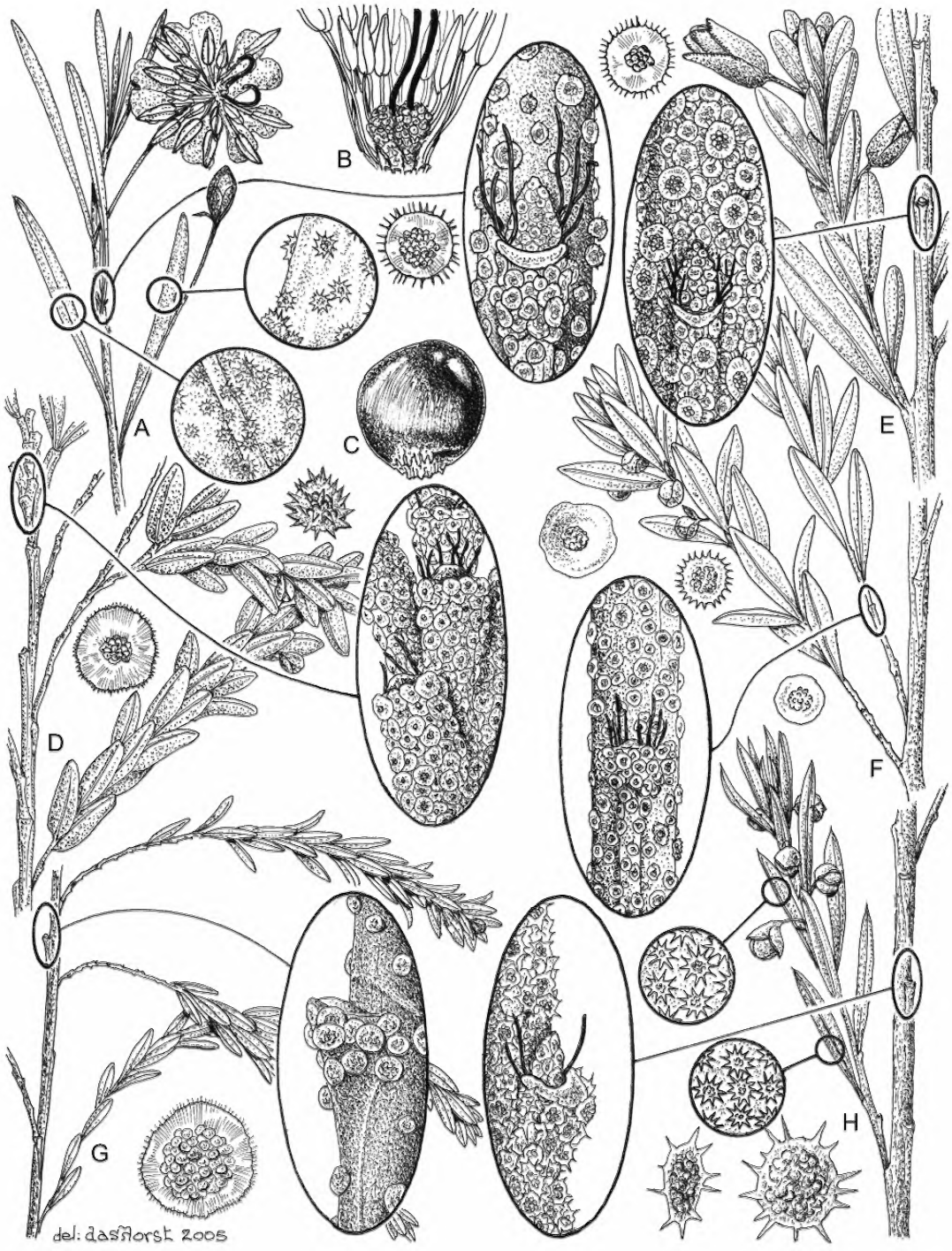


Fig. 7. A–C *H. guttata*: **A** flowering branch ×1; **B** flower showing longer and shorter stamens and shortly stalked ovaries ×4; **C** seed ×10. **D–H *H. echiifolia* — D** subsp. ***echiifolia***: flowering branch ×1; **E** subsp. ***macrantha***: fruiting branch ×1; **F** subsp. ***oligantha***: flowering branch; **G** subsp. ***cernua***: flowering branch ×1; **H** subsp. ***rotata***: flowering branch ×1. — **A–C** *I.D.Cowie 5647 & K.G.Brennan*; **D** *R.Brown MEL 1551091*; **E** *P.Martensz & R.Schodde AE574*; **F** *R.Schodde AE543*; **G** *L.A.Craven 5828*; **H** *L.A.Craven & G.Whitbread 7933*.

In the other subspecies with predominantly spherical flower buds the flowers are clustered by contraction of the axis between the three intermittent leaves, which are reduced to scales between successive flowers. A third flower is often produced in subsp. *oligantha* (e.g. *R.Schodde AE543*) from a short shoot in the axil of a subterminal leaf, and it has usually three scale-like leaves on the stalk below. Occasionally two similar such terminal branches double up at the end of a branch, so that up to five terminal flowers were observed. This terminal inflorescence has developed as result of a strong acrotonous development (also observed in *H. eciliata*), while in most species of the §*Tomentosae* a stronger basitonous development with flowers all along the branches is found.

This is the only species of *Hibbertia* known at present in which the flat erect leaves are more or less turned end on to the light by being appressed to the branches under dry conditions (*H.R.Toelken 9483*). Both surfaces are also more or less alike in colour and tomentum, in contrast to those of species in the §*Tomentosae*, which have either on the two surfaces a different denseness of tomentum and/or develop incurved or revolute leaf margins. The leaves of *H. echiifolia* seem to simulate the phyllodes of acacias.

More material and discerning field observations are needed of the habitat and flowers, especially their arrangement to assess more critically the validity of the subspecies.

Typification. Although in his manuscript, R.Brown crossed out and replaced his original epithet "echiifolia" with "tetragyna", Bentham (1863) adopted the former. His brief description was very general and could be applied to all of Brown's specimens of this species examined. The most complete branch with obvious ridges decurrent from the leaf bases of the left specimen of sheet BM 797276 was selected as lectotype of *H. echiifolia*, because the name of the species was also written on the label in what seem to be Bentham's handwriting. This was the only sheet found annotated by Bentham and was also accompanied by one of Brown's typical field labels. It is therefore not relevant that Brown had considered this collection a variant, "Hibbertia tetragyna β", and it was from a different locality (Bay 3) than that on which he had based his description, but which Bentham did not use. The two branches on the sheet including the lectotype were slightly different to those from Winchelsea Island, as they seem to be derived from fast growing young branches "with prominent angles decurrent from the base" of the leaves (Bentham 1863, p.31). The two different collections were kept under the same J.J.Bennett number (4859) and all of them were presumably consulted together by Bentham, so that all specimens of the two different collections by Brown of this species were considered as syntypes (cf. *H. lepidota*: typification). However, in the case of most type specimens, details are lacking to determine with certainty to which of two Brown collections they must be attributed.

Bentham (1863) did not base his description on Brown's detailed manuscript so that the author of the species should be "R.Br. ex Benth.".

The type MEL 1551090 consists of a branch of each *H. echiifolia* and *H. oblongata* (presumably also type material), while the specimen NSW 86603 bears a branch of the latter and two leaves and a flower of the former (in a paper capsule).

Key to subspecies

1. Calyx lobes 9–14 mm long; long anthers 3.5–3.9 mm long . . . . . 20c. subsp. ***macrantha***

1: Calyx lobes 6–8 mm long; long anthers 2.2–3.2 mm long

2. Leaf apex shortly acuminate, without scales and simple hairs at tip; leaves fascicled-hairy . . 20e. subsp. ***rotata***

2: Leaf apex cuspidate, mucronate, with peltate scales and/or fascicled hairs; leaves mainly scaly

3. Branches (except nodes) ± glabrous; flowers subsessile, with ellipsoidal buds . . . . . 20b. subsp. ***cernua***

3: Branches and nodes densely scaly; flowers pedunculate, with spherical buds

4. Outer calyx subequal to inner ones; flowers solitary, terminal, with fully developed leaves between successive ones . . . . . 20a. subsp. ***echiifolia***

4: Outer calyx lobes 1/2–2/3 of inner ones; flowers in terminal clusters of 1–3 (–5) . . . . . 20d. subsp. ***oligantha***

13a. *Hibbertia echiifolia* subsp. *echiifolia*

Hibbertia kimberleyensis C.Gardner, Forest Dept Bull. W. Australia 32: 68 (1923); Enum. Pl. Austral. Occ. 82 (1931); Beard, W. Austral. Pl. edn 1, 67 (1965); A.S.George & Kenneally, Wildlife Research Bull. West. Austral. 6:52 (1977); N.G.Marchant & Keighery, Kings Park Research Notes 5: 63 (1979). — **Typus**: Western Australia, between Calder and Prince Regent divide, *C.A.Gardner 1392*, 18.iv.1921 (holo.: PERTH).

Shrubs up to 0.5 m tall, one to few spreading stems. *Branches* winged, densely scaly, wiry to stiffly woody. *Leaf lamina* oblong-elliptic to oblong-lanceolate, (7.1–) 13–40 (–73.6) × (2.6–) 5–8 (–17.2) mm, with terminal mucro scaly or rarely with cactiform fascicled hairs, densely scaly and often with cactiform fascicled hair. *Flowers* 1 terminal, with buds obovoid to almost spherical, peduncle 3.2–5.8 mm long. *Calyx lobes* subequal, 6.2–7.6 (–8.1) mm long, with outer ones scarcely shorter. *Anthers* shorter ones 2–2.2 mm long, longer ones 2.5–2.6 mm. *Flowering*: January–June. **Fig. 7D**.

Distribution and ecology. Open heath-like vegetation on sandstone mainly in coastal areas in the Northern Province of Western Australia (NK), north-eastern Northern Territory (A) and Queensland (Bk).

Conservation status. Very rare and unknown.

Variation. The specimens *P.K.Latz 3381* from Wessel Island is the only recent collection of this species from coastal northern Arnhem Land, but the specimen is very much more robust than the type, probably because the

area was "recently burnt", and the second sheet (NT 36903) shows already much more delicate branches and smaller leaves as usually would be found in mature plants. It is interesting that flowers of the robust specimen as well as the less robust one had four pistils, each with two ovules.

The leaves of Queensland plants are somewhat narrower, but agree in all other respects with those of the typical subspecies.

Little is known about the habit of plants in this species but it seems significant that three specimens of this subspecies record a woody tuber. Annotations on *A.V.Slee & L.A.Craven 2729* from the Northern Territory and *M.D.Barrett 1542* and *2092* from Western Australia state that plants were lignotuberous: "resprouting after fire, with thick woody lignotuber with several taproots, one each arising from each large woody swelling of lignotuber". For all other specimens the base of plants of this species was not recorded.

Typification. In the description of *H. kimberleyensis*, Gardner also referred to Charnley River Gorge but this must have been based on a sight record as no extra collector's number was provided. The specimen *C.A. Gardner 1392* from "between Calder & Prince Regent divide" is treated here as the holotype.

Specimens examined

WESTERN AUSTRALIA: *M.D.Barrett 1542*, 4.2 km E new Theda Homestead, 16.ii.2005 (PERTH); *M.D.Barrett* 2092, 4 km E new Theda Homestead, 27.iv.2008 (PERTH); *P.A.Fryxell, L.A.Craven & J.McD.Stewart 4677*, 30 miles SW Mitchell Plateau Mining Camp, 8.vi.1985 (CANB); *C.A.Gardner 1392*, between Calder and Prince Regent rivers, 18.iv.1921 (PERTH).

NORTHERN TERRITORY: *A.V.Slee & L.A.Craven 2729*, 19.5 km ENE Mary River ranger station, 21.iv.1990 (CANB, DNA); *P.K.Latz 3381*, Wessel Island, 2.x.1972 (NSW, NT).

QUEENSLAND: *N.Byrnes 3291*, Crocodile Station, N Laura River, 16.v.1975 (BRI, QRS); *W.Hinton 9*, 36 km SW Laura, ii.1978 (BRI).

13b. *Hibbertia echiifolia* subsp. *cernua* Toelken, *subsp. nov.*

A subsp. oligantha *ramis plus minusve glabris alabastrisque solitariis ellipticies; a subspeciebus aliis foliis et ramis subglabris alabastrisque parvis ellipticis differt.*

Typus: Northern Territory, 44 miles SE Oenpelli, *C.R.Dunlop 4917*, 13.vi.1978 (holo.: CANB; iso.: CANB, sheet 2, DNA, NSW, NT; BRI, K – n.v.)

Hibbertia sp. 4 Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988) (*L.G.Adams & M.Lazarides 3100*).

Hibbertia sp. 3 K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996) (*K.G.Brennan 245*).

Shrubs up to 2 m tall, with one to few stems, with young branches often drooping. *Branches* with few scattered scales, more or less ridged, usually wiry-woody to twiggy. *Leaf lamina* elliptic, (4.8–) 10–20 (–26.8) × (0.9–) 2–4.5 (–8.3) mm, with short glabrous mucro, with few scales scattered over both surfaces. *Flowers* single, terminal, often hidden in surrounding leaves, with buds ellipsoidal, peduncle 0-3 mm long. *Calyx lobes* unequal, with outer ones (4.5–4.75 (–5.9) mm long) slightly shorter than or subequal to inner ones (4.6–4.9 (–7.6) mm long), with brown cilia towards the apex. *Anthers*: shorter ones 1.35–1.55 mm, longer ones 1.9–2.3 mm long and straight or scarcely curved, with slightly longer filaments. *Flowering*: January–June. **Fig. 7G**.

Distribution and ecology. Grows usually in scrub vegetation on sandstone of the western escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Unknown.

Variation. Although the characteristic slender elliptic leaves of this subspecies were at times somewhat broader and more like those of subsp. *oligantha*, the branches were less scaly and the single flowers have ellipsoidal buds with subequal calyx lobes and are in contrast to those of the latter subsessile. The two were found over a similar distribution range, but do not seem to occur sympatrically and do not seem to be compatible possibly because the stamens are scarcely differentiated in subsp. *cernua*. There were only few long ones and these were generally not curved; they also had only slightly longer filaments so that usually no clear separation (similar to subsp. *macrantha*) between the two types of anthers could be found as observed in subsp. *oligantha*.

Etymology. The epithet "cernua", Latin "drooping", is based on frequent records on herbarium specimens describing plants as drooping or weeping.

Specimens examined

NORTHERN TERRITORY: *L.G.Adams & M.Lazarides 3100*, 31 km ENE Goodparla station, 26.ii.1973 (CANB, NT); *K.G.Brennan 245*, Sawcut fault confluence, 7.i.1990 (DNA); *K.G.Brennan 6207*, Graveside Gorge, 19.iii.2004 (AD); *J.Brock 775 & J.Russell-Smith*, upper East Aligator River, 20.ii.1991 (BRI); *L.A.Craven 2295*, sandstone plateau, 19.ii.1973 (CANB, NT); *L.A.Craven 5828*, 3.5 km ESE Jim Jim Falls, 23.v.1980 (CANB, MEL); *L.A.Craven 6233*, 25 km WNW Twin Falls, 1.vi.1980 CANB); *L.A.Craven 6397*, 31 km WSW Twin Falls, 5.vi.1980 CANB); *C.R.Dunlop 5689*, Jim Jim Falls, 30.1.1981 (CANB, BRI, DNA, NSW); *R.W.Johnson 4534*, 19 km E Jabiru, 18.vi.1989 (BRI); *D.L.Jones 1444*, near Mt Howship, 19.ii.1984 (BRI, CANB, DNA); *P.K.Latz 7807*, 44 km SE Oenpelli, 15.vi.1978 (NT); *P.Martensz & R.Schodde AE564*, 2-3 miles N El Sharana, 25.i.1973 (CANB, NT); *A.V.Slee & L.A.Craven 2528*, upper Birdie Creek, 18.iv.1990 (DNA).

13c. *Hibbertia echiifolia* subsp. *macrantha* Toelken, *subsp. nov.*

A subspeciebus aliis floribus majoribus praecipue lobis calycis 9–11 (–14) mm longis antherisque longioribus 3.5–3.9 mm longis differt.

Typus: Northern Territory, 14 km E Sleisbeck, *G.J.Leach 2762 & I.D.Cowie*, 18.iv.1990 (holo.: CANB; iso.: AD, CANB, DNA; BRI, MEL, PERTH, n.v.)

Shrubs up 2 m tall, with one to few stems. *Branches* densely scaly, winged, usually robust woody. *Leaf lamina* oblong-elliptic, (9.2–) 15–30 (–51.9) × (3.1–) 4–7.5 (–9.8) mm, with terminal mucro scaly, densely scaly and/or rarely with cactiform fascicled hairs. *Flowers* terminal, single or with at least three fully developed leaves between successive ones, with buds ellipsoidal to cylindro-pyriform, peduncle 5–8.8 mm long. *Calyx* lobes subequal, 9–11 (–14) mm long, with brown cilia. *Anthers*: shorter ones 2.8–3.05 mm and straight, longer ones 3.5–3.9 mm long ± curved and with filaments slightly longer than the former. *Flowering*: January–May. **Fig. 1L; 7E**.

Distribution and ecology. Grows usually on sandy soil on sandstone in open eucalypt woodland often with spinifex on the southern parts of the escarpment of the Arnhem Plateau, Northern Territory (A), or on outliers nearby.

Conservation status. Locally frequent.

Notes. In this form there are at least three fully developed leaves between successive flowers, so that the pyriform flower buds are widely spaced and become leaf-opposed.

Etymology. The epithet "macr-antha", Greek "large-flowered", refers to the unusually large flowers described by some collectors as 3–4 cm in diameter.

Specimens examined

NORTHERN TERRITORY: *L.A.Craven 6726*, Katherine Gorge above Lily Pond, 7.iv.1981 (BRI, CANB, MEL); *C.H.Gittins 2837*, 65 km Pine Creek to UDP Falls, 30.iv.1975 (BRI, NSW); *P.Martensz & R.Schodde AE574*, 2–3 miles N El Sherana, 25.i.1973 (BRI, CANB, NT); *A.V.Slee & L.A.Craven 2528*, upper Birdie Creek area, 18.iv.1990 (AD, CANB).

13d. *Hibbertia echiifolia* subsp. *oligantha* Toelken, *subsp. nov.*

A subspecie typica squamis late dispersis in foliis, fruticibus ligneis usque ad 2 m altis floribusque minoribus differt.

Typus: Northern Territory, UDP Falls [Gunlom], 7 miles NW El Sharana, *R.Schodde AE 543*, 24.i.1973 (holo.: CANB; iso.: BRI, CANB, DNA, NT).

Shrub to 2 m tall, with one to few stems. *Branches* densely scaly, more or less ridged, usually twiggy becoming stiffly woody. *Leaf lamina* oblong to elliptic, (7.6–) 15–30 (–42.2) × (2.7–) 4–8 (–13.5) mm, with glabrous or few-scaled mucro, with few scales widely scattered on both surfaces. *Flowers* (1) 2 or 3 in terminal clusters from several nodes, with few scale-like leaves below peduncles, with buds spherical to pyriform, peduncle 2–6 (–8) mm long. *Calyx lobes* unequal, with outer ones (3.3–3.9 (–6.1) mm long) two-thirds to half the length of inner ones (6.1–6.8 (–8.8) mm long), often with pale brown cilia. *Anthers*: shorter ones 1.6–1.75 mm long and straight, longer ones 2.2–2.5 mm long and curved. *Flowering*: January–May. **Fig. 7F**.

Distribution and ecology. Grows among boulders or often at the base of rock faces in open eucalypt woodland usually on the western escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Locally frequent.

Variation. The leaf lamina varies greatly in shape and size and is sometimes ellipticas in subsp. *cernua*, which also occurs on the western escarpment of the Arnhem Land Plateau. The two subspecies are always easy to distinguish by the densely scaly branches and distinctly shorter outer calyx lobes in subsp. *oligantha*. The two subspecies are probably ecologically isolated as no specimens are known to contain both elements, nor have any intermediates been observed.

The flower buds of this subspecies are commonly spherical (with spreading peduncle) and become pyriform (with recurved peduncle) after flowering, but at all times they are more or less truncate at the apex in contrast to the ellipsoidal buds (with subequal calyx lobes) of subspecies *macrantha* and *cernua*. The calyx more or less elongates in the fruiting stage of all the subspecies.

Etymology. Several flowers in a terminal cluster is one of the characteristics of this subspecies as referred to in the epithet "olig-antha", Latinised Greek, "few-flowered".

Specimens examined

NORTHERN TERRITORY: *L.A.Craven 2429*, sandstone plateau, 27.ii.1973 (BRI, CANB, NT); *L.A.Craven & G.M.Wightman 8291*, near Mt Gilruth, 27.iii.1984 (AD, BRI, CANB); *I.D.Cowie 8483*, 18 km SE Mt Howship, 15.iii.2000 (CANB); *C.H.Gittens 2673*, 41 miles from Pine Creek to UDP Falls, vii.1973 (NSW); *G.J.Leach 2748 & I.D.Cowie*, 14 km E Sleisbeck, 18.iv.1990 (AD, DNA); *A.V.Slee & L.A.Craven 2538*, 10 Km ESE of junction of Katherine River and Gimbat Creek, 18.iv.1990 (AD, CANB, DNA); *G.M.Wightman 1353 & L.A.Craven*, East Alligator Headwaters, 30.iii.1984 (BRI, CANB, MEL).

13e. *Hibbertia echiifolia* subsp. *rotata* Toelken, *subsp. nov.*

A subspeciebus aliis foliis anguste ellipticis dense tectis pilis fasciculatis et apicibus breviter acuminatis pilisque simplicibus terminalibus differt.

Typus: Northern Territory, ca 30 km NNE Jabiru, *L.A.Craven & G.Whitbread 7933*, 28.iii.1981 (holo.: CANB; iso.: CANB, sheet 2, DNA, MEL).

Hibbertia sp. 11 K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996) (*K.G.Brennan 3222*).

Shrublets up to 3.5 m tall, with one to few stems. *Branches* densely covered with rosette-like to cactiform fascicled hairs, winged to ridged, stiffly woody. *Leaf lamina* elliptic, (8.6–) 22–35 (–53.3) × (2.8–) 4–7 (–9.5) mm, with terminal point ending into few simple hairs, densely covered with rosette-like and/or cactiform fascicled hairs on both surfaces. *Flowers* 1, 2 (3) in terminal clusters usuallyfrom several nodes, with scale-like leaves between and below peduncles, with buds

spherical to ellipsoid-pyriform, peduncle 1.2–3.4 (–5.3) mm long. *Calyx lobes* unequal, usually with brown cilia; outer ones (3.7–4.3 mm) and up to half as long as inner ones (7–8.5 mm). *Anthers* 2.4–2.8 mm long, straight to ± curved, all on long filaments. *Flowering*: November–May. **Fig. 7H**.

Distribution and ecology. Grows on sandstone or scree in woodland with *Eucalyptus herbertiana*, *Terminalia carpentaria*, *Ficus virens* etc on outliers of the escarpment between Nabarlek and Ubirr of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Rare.

Variation. The fascicled hairs on the branches and leaves vary considerably from rosette-like to cactiform on one branch. The characteristic simple hairs on the terminal point of the leaves are usually only visible when young and soon wear off.

The elliptic leaves are very similar to those of subsp. *cernua*, but those of the latter have very few scales, become blackish-brown when dried and their apex is not as sharply pointed.

Etymology. The appressed rays of the rosette-like fascicled hairs are subequal and look like wheels, which in this case stand out because they rarely overlap. Hence epithet "rotata", Latin "wheeled".

Specimens examined

NORTHERN TERRITORY: *K.G.Brennan s.n.*, near Ubirr Rock, 24.xi.1984 (DNA); *K.G.Brennan 3222*, 15 km SW Nabarlek, 13.iv.1996 (DNA); *K.G.Brennan 3581*, near Gamarrgawan outstation, 13.xi.1997 (DNA); *I.D.Cowie 8313*, S Ubirr, 21.iv.1999 (CANB); *C.R.Dunlop 7176 & P.Munns*, Tin Camp Creek, 27.x.1987 (AD); *R.Hinz 463*, Nabarlek, 23.iii.1989 (CANB).

2. *Hibbertia tomentosa* group

Vestiture: rosette-like fascicled hairs and/or peltate scales, marginal cilia/scales on calyx usually broad-based, unilaterally expanded. *Branches* rarely terete, usually ridged to winged from the centre of the leaf base. *Flowers* mainly "axillary", with usually spherical to pyriform buds; bracts mainly lanceolate to ovate. *Inner calyx lobes* broadly obovate, rounded. *Stamens* usually < 30; *anthers* subequal, (0.6–) 0.8–1.5 (–2.6) mm long.

Diagnostic features. Anthers subequal, (0.6–) 0.8–1.3 (–3.5) mm long. Style base glabrous. Vestiture: rosette-like fascicled hairs and/or scales on vegetative organs; marginal cilia/scales on calyx usually broad-based and unilaterally expanded.

Content. The *H. tomentosa* group is divided into six subgroups (*H. tomentosa* subgroup, *H. orbicularis* subgroup, *H. alopecota* subgroup, *H. oblongata* subgroup, *H. stirlingii* subgroup, *H. lepidota* subgroup) and contains 39 species.

Notes. The greatest number of species occurs in the Northern Territory and fewer are found in Western Australia and/or Queensland. Most of the species occur in a restricted area and only a few extend their distribution east or west. *H. lepidota* is the only species that has been recorded from all three states.

The small subequal anthers and unilaterally expanded marginal cilia on bracts and calyx observed in most of the species could indicate that the *H. tomentosa* group is monophyletic.

The large number of species as well as the diverse developments observed in the Northern Territory invite attempts at further subdivision. The delimitation of the following six subgroups is complex and not always clear-cut but should provide manageable groupings of species which at least show extreme developmental lines if not distinct groups. The divisions within the subgroups are for convenience and, although attempts were made to arrange them and the species within phylogentically, information is limited about the relations between them and even about some of the species in each of these subgroups.

2.1. *H. tomentosa* subgroup

Vestiture: *leaves* with subequal erect rosette-like hairs with subequal and unequal arms also on apical vein-ends, denser abaxially. *Calyx* rarely with marginal stellate cilia. *Branches* terete, rarely angular. *Leaves* with indistinct petiole, flat with ± recurved margins, with central vein scarcely raised. *Flowers* terminal, buds ellipsoidal with outer calyx lobes erect-beaked, and acute inner ones. *Petals* scarcely lobed. *Anthers* (12–) 15–20, subequal, (0.6–) 0.8–1.3 (–1.5) mm long.

Diagnostic features. The flowers of these three species do not have the spherical bud typical of species of the *H. tomentosa* group. The species are characterised by ellipsoidal to beaked flower buds similar to those commonly found in the *H. melhanioides* group, but in contrast to those the flowers of the *H. tomentosa* subgroup are smaller and the anthers are subequal.

Content. Species 14–16. *H. tomentosa*, *H. angulata*, *H. ligulata*.

Notes. While *H. tomentosa* is locally common along the escarpment of the Arnhem Land Plateau, *H. angulata* and *H. ligulata* are known from restricted localities on the coastal plains.

Among the species with short subequal anthers, considered more primitive than flowers with anthers of different length, these three species are distinguished by the following also not advanced characters: their ellipsoidal buds, beaked outer calyx lobes or acute inner ones, and scarcely lobed petals, and most importantly fascicled cilia on the margins of the calyx lobes.

H. tomentosa was here taken as the first species in this group as it has three beaked outer calyx lobes and acute two inner ones, as a similar combination of these characters is associated with primitive species in the *H. melhanioides* subgroup. It is interesting to note that most of the species of the latter two groups are broad-

leaved while the narrow linear leaves of this subgroup are probably derived.

14. *Hibbertia tomentosa* R.Br. ex DC.

Syst. Nat. 1: 432 (1817); Prodr. 1: 75 (1824); G.Don, Gen. Hist. 1: 76 (1831); Benth., Fl. Austral. 1: 30 (1863); F.Muell., Syst. Cens. 1: 2 (1882); Sec. Syst. Cens. 1: 2 (1889); Gilg, Nat. Pflanzenfam. 3, 6: 117 (1893); Ewart & Davies, Fl. North. Terr. 193 (1917); Gilg & Werderm., Nat. Pflanzenfam. 2 edn, 21: 26 (1925); Specht in Specht & Mountf., Rec. Amer.-Austral. Sci. Exped. Arnhem Land 3, 261, 364, 400, 464 (1958); Chippend., Proc. Linn. Soc. N.S,W. 96: 249 (1972); A.S.George & Kenneally, Wild. Res. Bull. West. Austr. 3: 46 (1975), pro parte excl. specimen *A.S.George 12544*, cf. *H. suffrutescens*; Harmer, N. Austr. Pl. 1: 46 (1976); N.G.Marchant & Keighery, Kings Park Research Notes 5: 64 (1979), pro parte; Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988); K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996); R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007. — **Typus**: Northern Territory, Winchelsea Island, *R.Brown s.n.* [J.J.Bennett 4864], 16.i.1803 (holo.: G-DC; iso.: BM, K 2×, MEL 119833, MEL 119834, NSW).

Hibbertia sp. 14 K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996).

Shrublet up to 0.5 m tall, often much branched, spreading to decumbent; branches terete, rarely slightly ridged below the centre of the leaf base when young, tomentose. *Vestiture* persistent, with dense erect-spreading rosette-like broad- to narrow-based fascicled hairs on branches, leaves and bracts, and with ciliate-peltate to entire scales ± overtopped by rosette-like fascicled hairs on calyx lobes; *on branches* dense erect-spreading subequal rosette-like ± broad-based fascicled hairs with few slightly larger ones mainly at the nodes (6–12 subequal arms); *on leaves above* very dense, with subequal erect-spreading rosette-like broad- to narrow-based fascicled hairs (6–8 subequal arms) and often with broader bases and sometimes more arms towards the margins; *on leaves below* very dense spreading rosette-like, usually narrow-based fascicled hairs (6–12 subequal arms) or slightly larger on the central vein and on the flanks; *on bracts* above and below ± dense but slightly less dense above, with spreading rosette-like ± broad-based fascicled hairs with some slightly larger ones particularly on the margins; *on outer calyx lobes* outside dense to very dense, with small narrow-rimmed peltate scales overtopped by larger reflexed to spreading rosette-like usually broad-based fascicled hairs on the central ridge and margins, inside glabrous on lower two-thirds becoming sparsely covered with narrow-based fascicled hairs distally; *on inner calyx lobes* outside very dense, with small peltate scales overtopped by few ± ciliate-peltate hairs towards the apex and few fine stellate cilia along the upper margin, inside glabrous. *Leaves* without axillary tufts of hairs; *petiole* 0–0.3 mm long, indistinct; *lamina* linear-elliptic, (2.7–) 5–12 (–16.8) × (0.6–) 1–3 (–5.8) mm, acute, gradually tapering into petiole, entire or rarely tridentate when young, flat with ± recurved but rarely revolute margins, above slightly grooved along the central vein and tomentose, below with central vein ± raised and rarely straight intramarginal one visible close to the margins, tomentose, indistinctly discolourous; juvenile leaves obtriangular to obovate with ± tridentate apex or rarely with two teeth on each side, flat or with slightly recurved margins, on both surfaces sparsely pubescent with scattered ± appressed rosette-like fascicled hairs, most of them narrow-based but few on veins broad-based. *Flowers* terminal, solitary, becoming leaf-opposed, usually on short lateral branches, with buds narrowly ovoid to rarely ellipsoidal; *peduncle* thread-like, 3.6–10.7 mm long, terete; *bracts* linear, linear-elliptic to rarely-oblanceolate, (2.3–) 2.5–4 (–4.6) × 0.25–0.6 mm, acute, flat and scarcely ridged, with slightly recurved margins, outside pubescent to rarely ciliate-scaly but usually larger fascicled hairs towards the margins, inside shortly pubescent. *Calyx* with lobes unequal; *outer calyx lobes* (3) linear-lanceolate, (3.8–) 4–4.5 (–4.9) × 1.7–1.9 mm, distinctly longer than inner ones, acute to beaked, with central ridge and slightly spreading margins, outside densely scaly overtopped by rosette-like broad-based hairs mainly along the central ridge and margins, inside finely pubescent on upper half; *inner calyx lobes* (2) elliptic to lanceolate, 2.9–3.4 × 1.8–2.1 mm, acute to slightly hooded, with central ridge, outside densely scaly with few rosette-like fascicled hairs, rarely ciliate-scaly on upper central ridge, and glabrous narrow membranous margin, inside glabrous. *Petals* narrowly obovate, 2.8–5.7 mm long, distinctly bilobed. *Stamens* 14–20 (with or without few staminodes), subequal, in 4 or 5 bundles around the ovaries; *filaments* filiform, 0.5–0.7 mm long, scarcely connate basally; *anthers* obloid, 0.6–0.75 mm long, abruptly constricted above and below, incurved towards the apex. *Pistils* 2; *ovaries* broadly to depressed obovoid, densely scaly, each with 2 basal ovules, with delicate style attached to the outer apex then ± erect but claw-like only slightly curved forward with fine terminal stigmas situated at the apex of the incurved anthers. *Fruiting peduncle* elongating, ± recurved. *Seed* obloid to ± spherical, 2–2.2 mm in diam., black; *aril* a fleshy attachment extended into a cup-shaped membrane (without lobes) covering the lower third to half of the seed. *Flowering*: January–June. **Fig. 8A–F**.

Distribution and ecology. On sandy or gravelly soil often associated with sandstone outcrops on the western escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Locally common in widely separated localities.

Diagnostic features. The species is recognised by its tomentose, mainly linear-elliptic leaves rarely longer than 12 mm, fascicled hairs with subequal arms, and ellipsoidal to ovoid flower buds. The latter two characters in particular easily distinguish it from the often superficially similar forms of *H. oblongata* subsp. *brevifolia*.

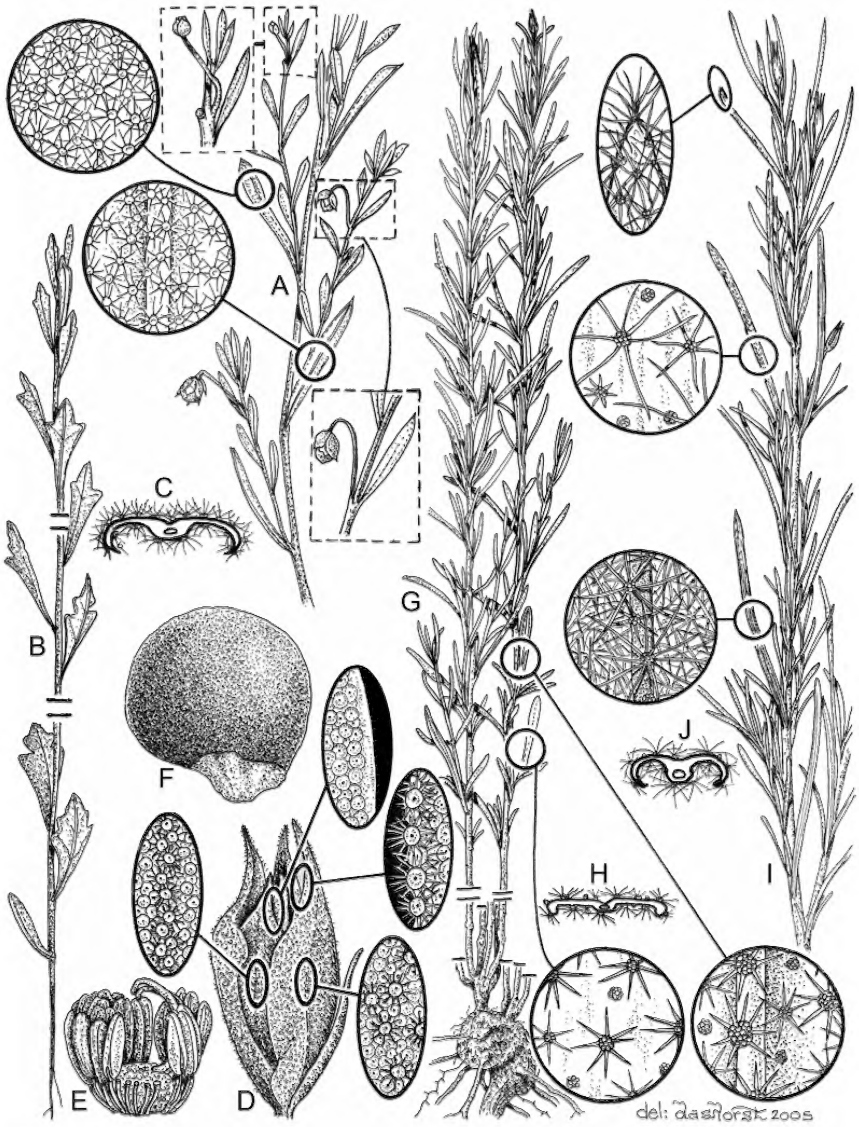


Fig. 8. A–F *H. tomentosa*: A flowering branch with terminal flowers becoming leaf-opposed ×1; **B** seedling with range of juvenile leaves ×1; **C** transverse section through mid-leaf x10; **D** flower bud ×10; **E** flower with calyx, corolla and front anthers removed ×10; **F** seed ×15. **G–H *H. ligulata*: G** plant with basal rootstock ×1; **H** transverse section through mid-leaf ×10. **I–J *H. angulata*: I** branch with flower buds ×1; **J** transverse section of mid-leaf ×10. — **A**, **C–E** *R.L.Specht 638*; **B** *R.Fensham 701*; **F** *K.G.Brennan 5112*; **G**, **H** *P.K.Latz 3725*; **I**, **J** *P.I.Foster 6058*.

Variation. The single lateral tooth on each side of juvenile leaves often are relatively large and subequal to the terminal point. Two teeth on either side of the leaf have only been observed on the first seven leaves on a seedling (*R.Fensham 701*).

Most of the hairs can clearly be recognised as rosette-like fascicled hairs, but it is not always easy to determine whether these relatively small hairs are broad- or narrow-based.

Notes. George & Kenneally (1975) and again Marchant and Keighery (1979) recorded *H. tomentosa* from Western Australia but the relevant specimens are now placed in *H. suffrutescens* (*q.v.*). Although the latter has superficially similar small leaves densely covered with rosette-like fascicled hairs, its flower buds are almost spherical and the outer calyx lobes are bluntly acute and distally recurved thus more closely resembling *H. alopecota*.

Selection of specimens examined (36 seen)

NORTHERN TERRITORY: *K.G.Brennan 4076*, Upper Dinno Creek, 21.iv.1999 (DNA); *K.G.Brennan & C.R.Michell 5112*, Nitmiluk National Park, 6.ii.2001 (DNA); *I.D.Cowie 8618*, ca 62 km SSW Maningrida, 18.iii.2000 (AD); *L.A.Craven 2463*, sandstone plateau, 2.iii.1973 (CANB); *R.Fensham 701*, 17 km SE Twin Falls, 20.iii.1989 (DNA); *P.A.Fryxell & L.A.Craven 4235*, above UDP Falls, Gunlom, 21.v.1983 (CANB, DNA, MEL); *R.K.Harwood 1218*, 100 km N Gnukurr, 28.vi.2002 (DNA); *R.Hinz 163*, Nabarlek, 4.ii.1989 (DNA); *G.J.Leach 2809 & I.D.Cowie*, near Kurundie Creek, 20.iv.1990 (AD); *G.J.Leach 4398 & L.Greschke*, Dinner Creek, 21 vi.1995 (AD); *P.Martensz & R.Schodde AE577*, 2-3 miles N El Sharana, 25.i.1973 (CANB, DNA, NT); *J.Russell-Smith 8428 & J.Brock*, upper East Alligator River, 20.ii.1991 (BRI); *A.V.Slee & L.A.Craven 2523*, upper Birdie Creek, 18.vi.1990 (AD, CANB); *A.V.Slee & L.A.Craven 2726*, 19.5 km ENE Mary River Ranger Station, 21.iv.1990 (CANB); *R.L.Specht 638*, Bickerton Island, 21.vi.1948 (BRI, CANB, MEL, NSW, PERTH); *B.A.Wilson 509*, St Vidgeons Station, 15.iv.1991 (DNA).

15. *Hibbertia angulata* Toelken, *sp. nov.*

Hibbertiae ligulatae *similis sed loborum calicis costis centralibus prominentibus, 17–19 staminibus calicibusque dense tectis pilis fasciculatis differt.*

Typus: Northern Territory, 41 km from Berry Springs on Mondorah road, *P.I.Forster 6058*, 21.xi.1989 (holo.: BRI; iso.: DNA).

Hibbertia sp. Cox Peninsula (K.M.Manning 386): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrublets up to 0.2 m tall, multistemmed with rootstock; branches usually stiffly erect-spreading, slightly angular from the centre of the leaf base, hirsute. *Vestiture* persistent, with erect to spreading usually rosette-like broad- to narrow-based fascicled hairs on leaves, branches and bracts, and with peltate scales overtopped by fascicled hairs on calyx; *on branches* dense to very dense, with large and small erect rosette-like broad- to often narrow-based fascicled hairs (6–10 subequal arms) over scattered smaller reflexed to cactiform fascicled hairs particularly around nodes; *on leaves above* moderately dense to dense, with few larger ones mainly along the flanks of the revolute margins over widely as well as evenly distributed smaller erect to spreading (not reflexed but approaching cactiform) rosette-like broad-based fascicled hairs (5–8 subequal arms); *on leaves below* dense to very dense, with scattered larger coarser spreading rosette-like broad-based fascicled hairs (6–10 subequal arms) over few smaller to cactiform fascicled hairs on the revolute margins and raised broad central vein, and with very dense much finer larger ones over smaller usually reflexed rosette-like narrow-based fascicled hairs on the recessed and often not visible undersurface; *on bracts* above moderately dense and below very dense, like on leaves but smaller and with fewer hairs on the recessed undersurface; *on outer calyx lobes* outside very dense, with larger erect rosette-like broad-based fascicled hairs (8–15 subequal arms) over dense reflexed rosette-like broad-based fascicled hairs and/or ciliate narrow-rimmed peltate scales particularly on the lower parts, inside with sparse spreading hairs distally and glabrous basally; *on inner calyx lobes* outside with scattered larger spreading rosette-like broad-based fascicled hairs mainly along the central ridge and gradually decreasing towards the margins but often forming stellate cilia on the margins over appressed narrow-rimmed peltate scales, inside glabrous. *Leaves* without axillary tufts of hair; *petiole* 0–2 mm long, indistinct; *lamina* linear, rarely linear-elliptic, (8–) 10–20 (–31.2) × (0.7–) 1.0–1.8 (–2.3) mm, acute to bluntly acute, scarcely constricted into petiole, entire, above slightly grooved along the central vein and usually sparsely hirsute, below with broad raised central vein and revolute margins all ± densely hirsute, with finely tomentose undersurface rarely visible between them, vaguely discolourous; juvenile leaves (coppicing) oblong to oblong-ovate, entire, with scarcely recurved margins and hardly raised central vein; sparsely covered with few spreading rosette-like hairs, proximally not broad-based fascicled hairs on upper surface and flanks and with very few hairs on undersurface. *Flowers* 1, terminal becoming leaf-opposed, commonly on lateral branches, with buds ellipsoidal; *peduncle* filiform, 10–13 (–16) mm long, terete; *bracts* linear-triangular, 4.8–6.4 × 0.5–0.6 mm, acute, almost terete, sparsely hirsute above and below. *Calyx* with lobes unequal; *outer calyx lobes* (2) linear-lanceolate, 4.4–5.3 × 1.2–1.4 mm, distinctly longer than inner ones, acute to acuminate, strongly ridged, outside sparsely hirsute with scaly undercover, inside sparsely hirsute distally, glabrous below; *inner calyx lobes* (3) oblong-lanceolate, rarely ovate, 4.1–4.7 × 1.8–2.2 mm, acute to acuminate, outside shortly hirsute along central ridge and towards apex over dense scales, inside glabrous. *Petals* obovate, 4–5.2 mm long, scarcely bilobed to emarginate. *Stamens* 17–19 (with 2 staminodes), subequal, in 5 bundles around the ovaries; *filaments* filiform, 1.2–1.4 mm long, scarcely connate basally; *anthers* obloid, 1.3–1.5 mm long, abruptly constricted above and below, scarcely incurved. *Pistils* 3; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with style attached to the apex then curved up and around but with constricted stigma turned upwards or incurved well above the anthers. *Fruit* and *seeds* not seen. *Flowering*: November–December. **Fig. 8I, J**.

Distribution and ecology. Found in white sandy soil under *Eucalyptus miniata* woodland or open forest on the Cox Peninsula, west of Darwin, Northern Territory (A).

Conservation status. Locally common.

Diagnostic features. The species is very similar to *H. ligulata*, but *H. angulata* is distinguished by prominent ridges on the calyx lobes, which are more or less fascicled-hirsute with few or no peltate scales and 17 to 19 stamens.

Etymology. The prominent ridges and acuminate apices of the calyx lobes give the ellipsoidal flower buds an

angular appearance unusual in this group of plants with a tendency for rounded calyx lobes and spherical buds. Hence the choice of the epithet "angulata", Latin, "angled".

Specimen examined

NORTHERN TERRITORY: *K.M.Manning 386*, Cox Peninsula, 17.iv.1988 (DNA).

16. *Hibbertia ligulata* Toelken, *sp. nov.*

Hibbertiae angulatae *similis sed calicis lobis sine costis centralibus prominentibus, staminibus paucioribus tomentoque differt.*

Typus: Northern Territory, Munmarlary Station, *P.K.Latz 3725*, 10.v.1973 (holo.: CANB; iso.: NT).

Shrublets to 0.2 m tall, multistemmed from thick rootstock; erect wiry branches slightly angular, scabrid to stubble-like. *Vestiture* persistent, with reflexed rosette-like, short-branched to cactiform fascicled hairs on branches, leaves and bracts, and mainly scales overtopped by few fascicled hairs on calyx; *on branches* moderate to dense, with few spreading large tubercled but usually short-branched rosette-like broad-based fascicled hairs (5–10 usually unequal arms) with commonly smaller cactiform fascicled hairs; *on leaves above* moderate to dense, with few larger spreading to reflexed rosette-like broad-based fascicled hairs mainly on the flanks of the revolute margins over/with dense cover of smaller subequal reflexed ones (9–15 subequal arms), rarely to cactiform ones on much of the surface; *on leaves below* dense, with similar coarser larger spreading rosette-like broad-based fascicled hairs (6–12 subequal arms) over few smaller and/or cactiform ones on the revolute margins and the raised central vein, and with very dense cover of much finer larger over smaller spreading rosette-like, usually narrow-based fascicled hairs on the rarely exposed undersurface inbetween; *on bracts* above and below slightly larger and smaller spreading rosette-like fascicled hairs; *on outer calyx lobes* outside with few spreading (erect along the margins) larger rosette-like broad-based fascicled hairs over appressed ciliate-peltate to entire scales, inside glabrous; *on inner calyx lobes* outside with scattered spreading to reflexed rosette-like broad-based fascicled hairs mainly along the central ridge but also few along the margins over dense peltate scales, inside glabrous. *Leaves* without axillary tufts of hair; *petiole* 0–0.3 mm long, usually absent; *lamina* linear, rarely linear-elliptic, (6.7–) 10–18 (–22.5) × (0.4–) 0.5–0.7 (–0.9) mm, acute to bluntly acute, scarcely constricted into petiole, entire, above slightly grooved along the central vein and pubescent to sparsely hirsute, below with broad raised central vein and often equally broad revolute margins all ± densely hirsute, and covering finely tomentose undersurface between them, vaguely discolourous as undersurface is rarely visible; juvenile leaves (coppicing) entire, sparsely covered with multiangulate fascicled hairs. *Flowers* 1, terminal becoming leaf-opposed, on main or lateral branches, with buds ellipsoidal; *peduncle* filiform, 5.8–6.7 mm long, terete; *bracts* linear, linear-triangular, 3.8–4.6 × 0.15–0.25 mm, acute, almost terete, sparsely hirsute above and below. *Calyx* with lobes unequal; *outer calyx lobes* (2) linear-lanceolate, 4.4–4.6 × 1.6–1.7 mm, distinctly longer than inner ones, acute, ridged, outside densely scaly overtopped by scattered fascicled hairs, inside glabrous; *inner calyx lobes* (3) oblong-lanceolate, rarely obovate, 3.5–3.8 × 1.7–2.0 mm, acute to acuminate, outside densely scaly overtopped by scattered fascicled hairs along central ridge and towards apex, inside glabrous. *Petals* obovate, 4.3–4.7 mm long, scarcely bilobed to emarginate. *Stamens* 12 (with 2 staminodes), subequal, arranged in 5 bundles around the ovaries; *filaments* filiform, 0.7–0.9 mm long, scarcely connate basally; *anthers* obloid, 1.1–1.25 mm long, abruptly constricted above and below, scarcely incurved. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely covered with peltate scales, with style attached to the apex then curved around but with constricted stigma turned upwards. *Fruiting peduncle* scarcely elongating, recurved. *Seeds* almost spherical, 2.3 × 2.1 mm, brown (immature); *aril* with fleshy basal attachment extending into a short cup-shaped, scarcely lobed sheath covering the base of the seed. *Flowering*: April–May. **Fig. 8G, H**.

Distribution and ecology. Infrequently found in red sand with open *Eucalyptus miniata*, *E. tetrodonta* forest on flats at the foot of the western escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Very rarely collected and frequency unknown.

Diagnostic features. *Hibbertia ligulata* is distinguished from the very close species, *H. angulata* and *H. scabra*, by only twelve stamens and very short arms of the reflexed fascicled hairs on branches and leaves. The latter two species have similar linear leaves.

Variation. Juvenile leaves or scales were not found on this plant so that observation of variation of the tomentum in juvenile to mature leaves could only be pursued on regenerating branches.

Etymology. The epithet "ligulata", Latin, "strap-like" refers mainly to the distinctive linear bracts but could equally be applied to the slender leaves.

Specimen examined

NORTHERN TERRITORY: *I.D. & A.K.Gibbons 9795*, NW Ramil Waterhole, 16.vi.2003 (AD, DNA).

2.2. *H. orbicularis* subgroup

Vestiture: unequal erect-spreading rosette-like hairs with unequal arms also on apical vein-ends, similar on both leaf surfaces or less dense abaxially, with marginal stellate cilia on the calyx. *Branches* terete. *Leaves* oblong to orbicular, flat with slightly recurved margins, with only scarcely raised central vein. *Flower buds*

spherical, on thread-like peduncles. *Anthers* (13–) 15–40, subequal, (0.7–) 0.8–1.1 mm long.

Diagnostic features. The species of the *H. orbicularis* subgroup are unusual in the §*Tomentosae* because the vestiture on the undersurface of leaves is less dense than that of the upper surface.

Content. Species 17–19. *H. cactifolia*, *H. scopata*, *H. orbicularis*.

Notes. *Hibbertia cactifolia* and *H. orbicularis* occur on the southern and northern end of the western escarpment of the Arnhem Land Plateau respectively, while *H. scopata* is known only from Theda Station in northern-western Western Australia.

These three species superficially resemble some of those of *H. alopecota* subgroup because of their similar coarse spreading hairs, and particularly as they share the unusual character of at least some of the hairs having one branch obviously longer than the others. The two groups are, however, tentatively kept separate because of the sparse vestiture on the abaxial leaf surfaces in the case of the three species of *H. orbicularis* subgroup. One is tempted to attribute this phenomenon to a retention of a juvenile character (neoteny), as young leaves of the *H. alopecota* subgroup show just that (cf. Juveniles stages of leaves). However, juvenile leaves of the *H. orbicularis* subgroup are even less hairy and some of them are lobed at least in *H. cactifolia* and *H. scopata*. Since their calyx lobes have stellate cilia in contrast to the unilaterally extended ones of the *H. alopecota* subgroup, these three species probably represent early derivatives of common ancestor(s) of the two groupings.

17. *Hibbertia cactifolia* Toelken, *sp. nov.*

Hibbertiae orbiculari *similis sed fruticis multicaulibus, laminis foliorum oblanceolatis vel ellipticis, bractiis longioribus differt.*

Typus: Northern Territory, Katherine Gorge above Lily Pond, *L.A.Craven 6728*, 7.iv.1981 (holo.: CANB; iso.: DNA, MEL).

Hibbertia sp. Nitmiluk (*L.A.Craven 6728*); R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrublet to 0.3 m tall, usually multistemmed, spreading to prostrate; branches terete, with slightly raised leaf bases, erect pubescent to ± hirsute. *Vestiture* persistent, commonly with rosette-like broad-based fascicled hairs on vegetative parts and mainly broad-rimmed scales on calyx; *on branches* ± dense, with erect to spreading multiangulate, usually broad-based rosette-like fascicled hairs (4–8 usually unequally long arms) with/over smaller similar hairs but usually without broad base; *on leaves above* moderate to dense, larger with/over smaller spreading to reflexed rosette-like broad-based fascicled hairs (6–12 usually unequally long arms); *on leaves below* moderate to dense, with larger rosette-like broad-based fascicled hairs (9–12 often unequally long arms) on the margins and the central vein over usually smaller similar fascicled hairs on the undersurface; *on bracts* above and below with scattered erect to spreading larger and smaller rosette-like fascicled hairs; *on outer calyx lobes* outside dense, with scattered large rosette-like broad-based fascicled hairs (10–14 usually unequally long arms) over dense smaller broad-rimmed peltate scales at the base becoming sparser and narrow-rimmed towards the apex, and on margins usually erect and more or less stellate cilia with few arms, inside with larger over smaller rosette-like broad-based fascicled hairs on upper half; *on inner calyx lobes* outside dense, with larger over smaller broad-based scales and on margins with simple hairs or rarely erect multiangulate fascicled hairs without broad base, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0–0.5 mm long, indistinct; *lamina* oblong-elliptic to elliptic, rarely elliptic-oblanceolate, (4.5–) 5.5–14 (–23.3) × (0.8–) 1–3 (–5.2) mm, obtuse to rounded, rarely acute and recurved, gradually tapering into petiole, entire, flat but with ± revolute margins, above grooved along the central vein and patent-pubescent to sparsely hirsute, below with central vein well raised as well as secondary and sinuate intramarginal veins ± visible, hirsute to patent-pubescent, discolourous; juvenile leaves (first few) entire, with fewer multiangulate rosette-like broad-based fascicled hairs. *Flowers* terminal becoming leaf-opposed on lateral branches, "axillary" on more or less developed short shoots on some terminal shoots, with buds more or less spherical; *peduncle* thread-like, 7.2–15.6 mm long, terete; *bracts* lanceolate-elliptic, rarely elliptic, 3.4–4.5 × 1.5–1.7 mm, acute, spreading and rarely recurved, flat or with slightly recurved margins, with raised central vein on undersurface, sparsely hirsute ranging to stubble-like smaller hairs. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate-elliptic, 3.9–4.6 × 2.6–3.2 mm, acute to obtuse, with central ridge on upper half, outside sparsely hirsute over dense to sparse scales, inside pubescent to rarely hirsute on upper half; *inner calyx lobes* (3) obovate to almost orbicular, 3.3–4.2 × 3.5–4.1 mm, with rounded apex, with membranous margin, densely scaly. *Petals* cuneate-obovate, 4.4–5.2 mm long, deeply bilobed. *Stamens* 26–28 (without staminodes) subequal, arranged in groups around the ovaries; *filaments* filiform, 0.5–0.9 mm long, scarcely connate basally; *anthers* obloid, rarely narrowly obovoid, 0.8–1 mm, with slightly incurved apex, abruptly constricted above and below. *Pistils* 2; *ovaries* reflexed ovoid, each with 2 basal ovules, densely scaly, with style attached to the dorsal apex then curved up- and forward to place the constricted stigma just above the apex of the anthers. *Fruiting peduncle* scarcely elongating, slightly recurved. *Seeds* obovoid to almost spherical, 2.2–2.5 × 2.2–2.3 mm, black or brown; *aril* with fleshy basal attachment expanding into a short cup-like sheath (not lobed) scarcely covering the base of the seed. *Flowering*: December–June. **Fig. 9A–E**.

Distribution and ecology. Growing on sandy soil mainly on sandstone in open forest with usually *Eucalyptus phoenicea* on lower slopes of the south-westernmost part

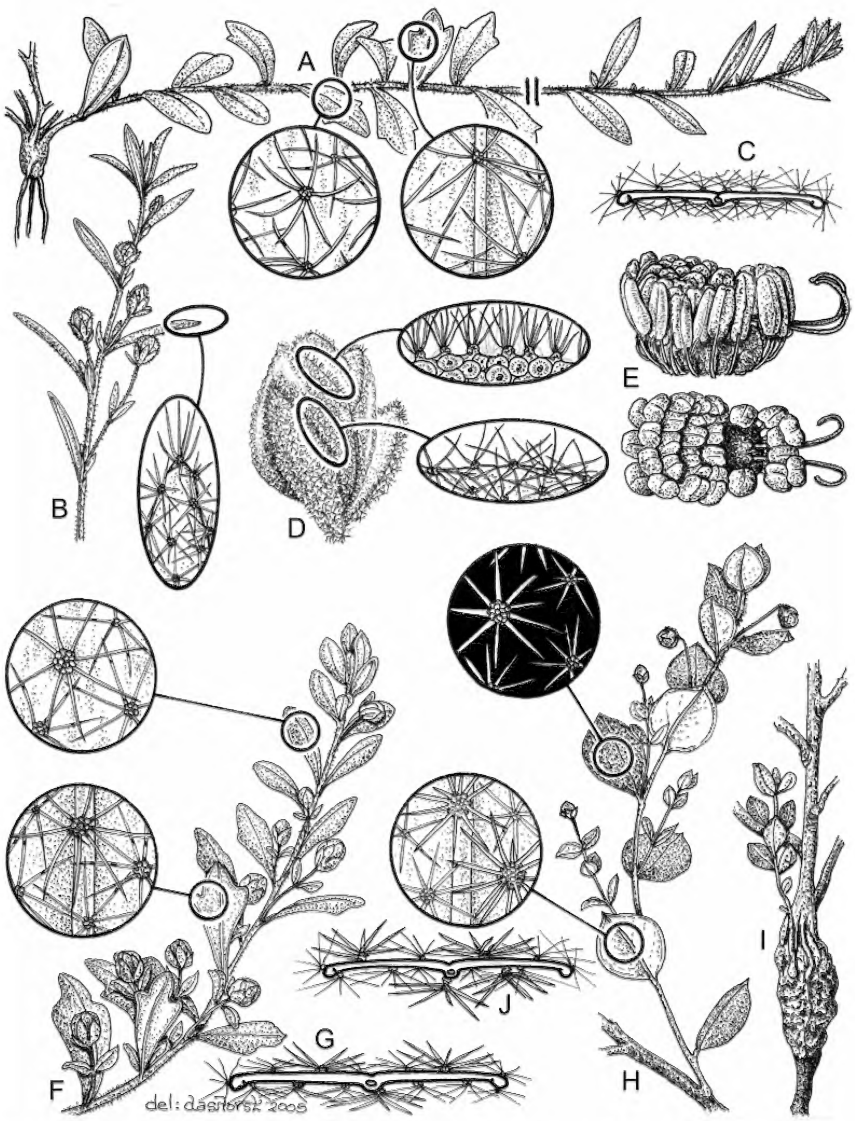


Fig. 9. A–E *H. cactifolia*: **A** basal rootstock with regenerating branch and juvenile leaves ×1; **B** branch with "axillary" flowers ×1; **C** transverse section through mid-leaf ×10; **D** flower bud ×6; **E** flower with calyx and corolla removed in lateral and top view ×10. **F–G *H. scopata***: **F** flowering branch ×1; **G** transverse section through mid-leaf ×10. **H–J *H. orbicularis***: **H** flowering branch ×1; **I** young plant with developing rootstock ×1; **J** transverse section through mid-leaf ×5. — **A** *K.G.Brennan 5268*; **B–E** *C.R.Michell 3050*; **F**, **G** *A.A.Mitchell 2970*; **H**, **J** *G.M.Wightman 1362 & L.A.Craven*; **I** *C.R.Dunlop 4881*.

of escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Locally common.

Diagnostic features. This species is very similar to *H. orbicularis*, but is distinguished by the elliptic-oblanceolate leaves, a multistemmed habit, a somewhat different vestiture, and larger bracts. *Hibbertia cactifolia* is superficially similar to *H. tomentosa* but on closer examination their habit, vestiture and calyx are very different.

Variation. *Hibbertia cactifolia* is similar to *H. orbicularis* in its spreading tomentum, flower structure and decumbent habit. Seedlings of the latter (*C.R.Dunlop 4881*) first establish a short woody stem, which becomes much branched ca 5 cm above the soil level and some of these branches then become longer and decumbent. In *H. cactifolia* (*H.R.Toelken 9494*) no individual stem is

distinguishable because branching starts at ground level. The plant soon consists of a number of prostrate to decumbent long shoots, each one rather more than less branched. Coppicing plants seem to develop in extreme cases (*K.G.Brennan 5263*) at first only unbranched long shoots with ultimately a few "axillary" flowers on extremely short short shoots, while in other specimens (e.g. *C.R.Michell 3050*, *I.B.Wilson 332*) axillary branches develop along the whole length becoming shorter distally so that flowers borne terminally on each of these branchlets show the whole range from terminal to "axillary" flowers.

The former specimen (*C.R.Michell 3050*) shows another unusual feature in that the 5th to 11th leaves on these coppicing long shoots each have two subterminal teeth, a feature not observed in any other specimens. That is of particular interest, since, in contrast to *H. tomentosa* (*q.v.*), these teeth are not on the first juvenile leaves. Other leaves of this species at times appear to have shallow teeth, because the relatively large broad-based fascicled hairs protrude from the margins.

Etymology. Under the microscope, the flat elliptic-oblanceolate leaves covered with robust spreading fascicled hairs are reminiscent of spine-clustered areoles on phyllocladia of, for instance, *Opuntia* leaves in the Cactaceae. The epithet "cacti-folia", Latin, "cactus-leaved" draws attention to this resemblance.

Specimens examined

NORTHERN TERRITORY: *K.G.Brennan 5263*, Nitmiluk, veg. site 130, 13.ii.2001 (DNA); *J.D.Briggs 849*, Edith Falls, 2.v.1983 (AD, CANB); *N.Byrnes NB81*, Katherine Gorge, 16.i.1967 (NT); *J.L.Egan 4722*, Edith Falls, 13.iv.1995 (AD); *M.Evans M3543*, above Nitmiluk visitor centre, 28.xii.1990 (CANB); *S. King 232*, Katherine Gorge behind Dunlop swamp, 7.vi.1983 (DNA); *C.R.Michell 3050*, Nitmiluk National Park, 7.ii.2001 (DNA); *T.M.Orr 319*, 8 km SE Katherine Gorge National Park headquarters, 3.iv.1989 (DNA); *I.B.Wilson 332*, 19 miles NE Katherine, 13.ii.1965 (DNA).

18. *Hibbertia scopata* Toelken, *sp. nov.*

Hibbertiae cactifoliae *similis sed setis antrorsis in paginis adaxialibus petiolorum et basium foliorum, staminibusque 13–15 differt.*

Typus: Western Australia, Noseda Creek, E end Napier Broome Bay, N Kalumbaru and just W of Drysdale River mouth, *A.A.Mitchell 2970*, 28.iii.1993 (holo.: PERTH).

Shrublets to 0.3 m tall, with one to few stems; branches wiry to rigid-woody becoming decumbent up to 0.45 m long, slightly ridged from the centre of the leaf base, hispid. *Vestiture* persistent, with ± dense robust erect-spreading rosette-like broad-based fascicled hairs on branches, leaves and bracts, and with mainly narrow-rimmed scales on the calyx; *on branches* sparse to dense, with robust erect-spreading rosette-like, usually broad-based fascicled hairs (4–10 usually unequally long arms, often to extremes); *on leaves above* moderate to dense, with about equally dense distribution of mainly spreading rosette-like broad-based fascicled hairs (5–7 often subequal arms) on the main blade but becoming progressively more antrorse towards the petiole; *on leaves below* moderate to dense, with robust erect to spreading rosette-like broad-based fascicled hairs (5–9 unequal to subequal arms) many of which are larger along the central vein and on the margins; *on bracts* similar to leaves; *on outer calyx lobes* outside very dense, with mainly narrow-rimmed scales overtopped by large spreading rosette-like broad-based fascicled hairs (8–12 subequal arms) along the central ridge and ± unilaterally extended marginal cilia towards the base and becoming stellate cilia distally, inside with short spreading rosette-like fascicled hairs on the upper third; *on inner calyx lobes* outside very dense, with mainly narrow-rimmed scales overtopped by few broad-rimmed ones along the central vein and with scattered marginal stellate cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.4–0.8 mm long, indistinct; *lamina* oblanceolate to elliptic-oblanceolate, (3.6–) 4–8 (–12.6) × (2.6–) 3–5.5 (–6.8) mm, acute and often with two lateral bluntly acute points, gradually tapering or with cuneate base, flat or more or less folded lengthwise at least when young, entire to tridentate, above ± grooved along the central vein and pubescent to hispid with increased bristles towards the petiole, below with slightly raised central vein and sparsely hispid, scarcely discolourous; juvenile leaves (lobed leaves not different in vestiture from entire ones) not seen. *Flowers* 1, "axillary" with or without short shoot vestiges, irregularly along branches, with buds almost spherical to slightly pyriform; *peduncle* thread-like, 3.1–4.6 mm long, terete; *bracts* linear-triangular to lanceolate, 3.4–3.9 × 1.3–1.5 mm, ca half as long as outer calyx, acute, with truncate base somewhat clasping, indistinctly ridged, distally ± recurved; below sparsely hirsute, above antrorsely pubescent-hirsute. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate, 4.6–5.2 × 2.4–2.6 mm, about as long as or longer than inner ones, acute, scarcely ridged towards the apex, outside densely scaly overtopped by robust spreading fascicled hairs along the central ridge and towards the margins, pubescent on the upper third; *inner calyx lobes* (3) obovate to broadly oblong-obovate, 4.2–4.6 × 2.3–2.9 mm, rounded, without central ridge, outside densely scaly and with or without stellate cilia along a membranous margins, inside glabrous. *Petals* obovate, 4.5–4.9 mm long, bilobed. *Stamens* 13–15 (without staminodes), subequal, in groups around the ovaries; *filaments* filiform, 1.1–1.4 mm long, scarcely connate basally, *anthers* obloid to narrowly ovoid, 0.8–1.0 mm long, ± abruptly tapering above and below, straight or slightly incurved. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with filiform style attached to the apex then erect and incurved above the clustered anthers. *Fruiting peduncle* scarcely elongating, slightly recurved. *Seeds* almost spherical, 2.3–2.45 × 2.3–2.3 mm, brown; *aril* with fleshy attachment expanding into

cup-like membrane (scarcely lobed) clasping the lower third of seed. *Flowering*: March. **Fig. 9F, G**.

Distribution and ecology. Growing in crevices of sandstone upland near the Drysdale River mouth, northern Western Australia (NK).

Conservation status. Unknown.

Diagnostic features. *H. scopata* is very similar to *H. cactifolia*, but is distinguished by fewer stamens per flower and the distinctive antrorse bristles on the upper surface of the petiole and lower leaves. The former in contrast to the latter often retains the toothed leaves even on adult branches.

Most of the leaves along the fast growing main branches are larger and with more or less tridentate apex, while leaves on the lateral branches tend to be entire.

Etymology. The choice of the epithet was prompted by the whole plant being "densely covered with bristly hairs", Latin, "scopata".

Specimens examined

Known only from the type collection.

19. *Hibbertia orbicularis* Toelken, *sp. nov.*

Hibbertiae cactifoliae *similis sed laminis foliorum orbicularibus vel late oblongis, frutici ramoso bracteisque minoribus differt.*

Typus: Northern Territory, headwaters of East Aligator River, *G.Wightman 1362 & L.A.Craven* (holo.: AD; iso.: BRI, CANB, DNA, MEL, NSW).

Hibbertia sp. 12 Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988).

Hibbertia sp. 4 K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996).

Hibbertia sp. Short leaf (*J.Russell-Smith 5193*); R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrublets to 0.3 m tall, with few stems; branches reddish, spreading to trailing, terete or rarely with slightly raised leaf bases, sparsely to densely irregularly erect-pubescent to rarely hirsute. *Vestiture* persistent, with rosette-like broad-based fascicled hairs on vegetative parts and mainly broad-rimmed scales on calyx; *on branches* sparse, with scattered larger erect rosette-like broad-based fascicled hairs (7–11 unequally long arms) over smaller ones (3–7 unequally long arms) to cactiform fascicled hairs with/without broad base; *on leaves* sparse and ± equally dense above and below, with larger over smaller scattered usually reflexed to spreading on margins, rosette-like broad-based fascicled hairs (3–8 usually unequally long arms); *on bracts* above and below with scattered spreading to erect rosette-like broad-based fascicled hairs mainly along the margins particularly on the upper surface; *on outer calyx lobes* outside densely scaly at the base and with scattered large rosette-like broad-based fascicled hairs (5–8 usually unequal arms) mainly towards the apex over smaller ones to cactiform fascicled hairs or narrow-rimmed scales, inside on upper half with larger over smaller rosette-like broad-based fascicled hairs; *on inner calyx lobes* outside very dense, with larger over smaller scales and margins brown-membranous with simple or stellate cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.2–1.5 (–1.6) mm long; *lamina* orbicular to broadly elliptic, (2.4–) 5–8 (–14.3) × (2.4–) 3–7.5 (–10.7) mm, cuspidate to mucronate with more or less recurved vein-end, becoming rounded to emarginate, abruptly constricted into petiole, entire, flat but with more or less recurved margins, above grooved along the central vein and sparcely pubescent; with central vein well raised and secondary veins more or less visible, sparsely patent-pubescent, discolourous; juvenile leaves often similar to adult ones except for fewer fascicled hairs. *Flowers* terminal becoming leaf-opposed, with bud ± spherical; *peduncle* thread-like, 3–6 (–7.8) mm long, terete but broadened below fruit; *bracts* lanceolate to ovate-acuminate, 1.3–1.8 × 0.8–1.15 mm, shorter than calyx, acute to acuminate and recurved distally, clasping peduncle, leaf-like, above slightly grooved and sparsely pubescent, below with central vein somewhat raised and more or less covered with cactiform to narrow-rimmed scales overtopped by few rosette-like broad-based fascicled hairs. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate-elliptic, 2.3–3.3 × 2.0–2.45 mm, outermost somewhat smaller, acute to acuminate, rarely obtuse, recurved distally, outside densely to sparsely scaly and with few rosette-like to cactiform fascicled hairs acropetally, inside sparsely hirsute on upper half; *inner calyx lobes* (3) obovate to almost orbicular, 3.1–3.55 × 2.3–2.6 mm, with ± rounded apex, with membranous margins fascicled ciliate, outside densely scaly, inside glabrous. *Petals* cuneate-obovate, 3.3–4.1 mm long, ± deeply bilobed. *Stamens* (30-) 35–40 (without staminodes), subequal, in bundles around ovaries; *filaments* moderately slender, 0.6–0.95 mm long, scarcely connate basally; *anthers* obloid, 0.7–1.1 mm long, abruptly constricted above and below, slightly incurved. *Pistils* 2; *ovaries* depressed-obovoid, each with 2 basal ovules, densely scaly, with style attached to the somewhat flattened apex then curved up- and outward but again forward to place the constricted stigma just above the anthers. *Fruiting peduncle* scarcely elongating, recurved. *Seeds* obovoid to almost spherical, 2.2 × 2.2 mm, black or brown; *aril* with fleshy basal attachment extended into a cup-like short sheath (not lobed) scarcely covering the base of the seed. *Flowering*: January–June. **Fig. 1B, C; 9H–J**.

Distribution and ecology. Growing on shallow soil on ledges or slopes on sandstone of the north-western part of the escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Locally frequent.

Variation. The specimen *C.R.Dunlop 4881*, especially the one at CANB, shows well the development from single-stemmed stiffly erect young to older plants with longer decumbent to trailing branches. The young erect plant shows also how, when several branches develop

from the base, it becomes broader and woody, so that mature plants may also seem to be multistemmed (cf. Fig. 9I) from a woody base as in *H. cactifolia* (cf. *H.R.Toelken 9494*).

The outermost of the three inner calyx lobes is in this species often cuspidate and thus somewhat intermediate between the two types of calyx lobes. This has also been observed in other parts of the genus, but among these species it is unusual.

Etymology. The epithet "orbicularis", Latin, "orbicular" refers to the unusual, almost round, leaves characteristic of the species.

Specimen examined

NORTHERN TERRITORY: *K.G.Brennan 246*, Sawcut confluence with East Alligater River, 3.i.1990 (DNA); *C.R.Dunlop 4881*, Mt Gilruth area, 3.vi.1978 (CANB, DNA, NSW, NT); *C.Michell 203 & S.Knox*, upper East Alligator River, 18.vi.1996 (DNA); *J.Russell-Smith 5193 & Lucas*, upper East Alligator River, 18.iv.1988 (CANB).

2.3. *H. alopecota* subgroup

Vestiture: *leaves* with unequal erect-spreading rosette-like fascicled hairs with unequal arms, i.e. often with one distinctly longer branch especially on adaxial leaf surface (cf. Fig. 2B of *H. tridentata*), or unilaterally enlarged hairs on vein-end, and denser vestiture abaxially. *Calyx* with sparsely unilaterally enlarged marginal cilia. *Shrublets* with spreading to decumbent wiry-woody branches terete to ridged. *Leaves* flat, with recurved to revolute margins, with central, lateral and intramarginal veins ± visible unless obscured by dense hair. *Flowers* "axillary", with spherical to pyriform buds. *Anthers* (12–) 15–25 (–35), subequal, 0.7–1.3 (–1.6) mm long.

Diagnostic features. These species usually have broad leaves covered with spreading hairs especially on the abaxial surface of the petiole and the vein-end. The bracts are very broad and often clasping the peduncle unlike most of the bracts in the *H. oblongata* subgroup.

Content. Species 20–25. *H. alopecota*, *H. tridentata*, *H. solanifolia*, *H. circularis*, *H. tricornis*, *H. mollis*.

Notes. Most of the species of this grouping occur along the western escarpment of the Arnhem Plateau but one very local species has been recorded from Western Australia.

They are characterised by dense spreading hairs (velutinous to rarely shortly hirsute in comparison with the hirsute ones of the *H. melhanioides* subgroup), especially along the lower surface of the petiole in contrast to the reflexed hairs of the very similar *H. oblongata* subgroup. These spreading arms are also present on the terminal vein-end of leaves in the *H. alopecota* subgroup while they are usually unilaterally enlarged and/or clustered into a terminal tuft in the *H. oblongata* subgroup. This is irrespective of the specific unequal branching of the hairs observed. For instance, the *H. alopecota* subgroup has hairs predominantly with one larger arm, which often develops extreme proportions on the upper surface of leaves of (e.g. *H. tridentata*). This contrasts strongly with the frequent development of two types of longer hairs, usually antrorse and retrorse, on the upper leave surface of species of the *H. oblongata* subgroup.

The leaves of the *H. alopecota* subgroup are usually broadly elliptic, ovate and usually abruptly constricted into a distinct petiole, while the *H. oblongata* subgroup has more or less oblong leaves tapering into an indistinct petiole. Leaves on mature branches of *H. alopecota* are often more or less lobed and in *H. tridentata* and *H. solanifolia* they are always lobed.

20. *Hibbertia alopecota* Toelken, *sp. nov.*

Hibbertiae auriculiflorae *similis sed pilis patentibus nunquam squamatis in ramis foliisque, foliis non oblongis; a* H. solanifolia *pedunculis brevis staminisque paucioribus; a* H. oblongata *habitu decumbente foliisque ovatis vel ellipticis differt.*

Typus: Northern Territory, Fisher Creek, *G.J.Leach 2785 & I.D.Cowie*, 19.v.1990 (holo.: AD; iso.: DNA; MEL – *n.v.*).

Hibbertia sp. 2 Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988).

Hibbertia sp. softly hairy (J.Must 1119): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Low shrubs to 0.6 m high, with spreading, decumbent to prostrate branches up to 1 m long; branches ± triangular in section with ridges from centre of leaf bases, sparsely to densely hirsute. *Vestiture* persistent, usually larger over/with smaller rosette-like broad-based fascicled hairs on vegetative organs to ± scaly on the calyx; *on branches* ± dense with scattered larger erect (which are often ± stalked), rosette-like broad-based fascicled hairs (7–9 usually unequal arms) over/with often denser smaller ones (4–8 often equal arms); *on leaves above* sparse to dense but usually less dense than on the undersurface, with scarcely larger and smaller usually spreading, rarely ± reflexed rosette-like broad-based fascicled hairs (6–12 with often 1–3 antrorsely or latrorsely distinctly longer arms); *on leaves below* usually very dense, with scattered distinctly larger (often ± stalked) rosette-like broad-based fascicled hairs (10–15 usually unequal and often erect arms) mainly along veins over smaller rosette-like broad-based fascicled hairs (7–10 arms usually larger antrorse ones); *on bracts* above (less dense) and below dense, larger over smaller erect rosette broad-based fascicled hairs and some scarcely unilaterally enlarged marginal cilia; *on outer calyx lobes* outside with scattered larger reflexed rosette-like broad-based fascicled hairs (12–16 subequal arms) mainly along the central ridge and margins usually as unilaterally enlarged marginal cilia over distinctly smaller reflexed rosette-like broad-based hairs towards the apex and ciliate-peltate scales to some narrow-rimmed peltate scales towards base, inside ± dense larger and smaller spreading rosette-like broad-based fascicled hairs; *on inner calyx lobes* outside with



Fig. 10 A–H *H. alopecota*: **A** flowering branch ×1; **B** flower bud covered by larger outer calyx lobes ×3; **C–H** varying leaf shapes on flowering branches ×1. **I–L *H. tridentata***: **I** flowering branch ×0.7; **J** transverse section through mid-leaf ×2.5; **K** linear bract ×10; **L** subequal stamens surmounted by stigmas ×8. **M–N *H. solanifolia***: **M** flowering branch ×1; **N** linear bract ×5. **O–Q *H. circularis***: **O** flowering branch ×1; **P** transverse section through mid-leaf ×2; **Q** broadly ovate bract ×10. — **A–D** *G.J.Leach 2780 & I.D.Cowie*; **C**, **D**, **E–H** *M.Lazarides 8903*; **I–L** *D.L.Jones 1463*; **M, N** *L.A.Craven & G.M.Wightman 8251*, **O–Q** *I.D.Cowie 8489*.)

dense narrow-rimmed peltate scales except for often some ciliate-peltate to rosette-like broad-based fascicled hairs below the apex and margins often with unilaterally enlarged to erect fascicled cilia on the margin of at least the outermost lobe, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* (0–) 0.4–1.0 (–2.3) mm long; *lamina* elliptic, elliptic-oblanceolate, rarely ovate, (4.8–) 10–30 (–55.6) × (3.8–) 6–20 (–28.3) mm, cuspidate to acute with vein-end densely hirsute, rarely becoming obtuse to rounded, often abruptly constricted into petiole, flat to slightly recurved margins, entire, toothed to shallowly lobed with rounded to acute apices with vein-ends, above ± grooved along the main vein and sparsely or rarely densely hirsute, below with main vein, often laterals and sometimes sinuate intramarginals ± raised, usually densely hirsute, discolourous; juvenile leaves (regenerating) broader, flat, with one tooth or lobe on either side, sparsely hairy. *Flowers* 1 (–3), "axillary",

but often with rudimentary leaf or rarely terminal on short shoots, with buds pyriform with elongated woody receptacle; *peduncle* short and stout, 5–12 mm long, angular to flattened; *bracts* ovate to elliptic-oblanceolate, 2.2–3.1 × 1.8–2.8 mm, ca half as long as outer calyx lobes but enlarging after flowering, acute to cuspidate, ± appressed, above pubescent, below hirsute and scarcely unilaterally enlarged marginal cilia. *Calyx* with lobes unequal; *outer calyx lobes* (2) oblanceolate-elliptic to oblanceolate, rarely obovate, 3.8–5.6 × 2.2–3.4 mm, acute often becoming bluntly acute, with central ridge ± raised, outside sparsely hirsute to usually scaly (narrow-rimmed) overtopped by ± scattered larger fascicled hairs especially along the margins usually as unilaterally enlarged cilia particularly towards the base, inside hirsute at least on the upper half; *inner calyx lobes* (3) oblong-obovate, rarely to almost orbicular, 3.2–4.7 × 3.6–4.4 mm, with rounded apex and with ± membranous margins with unilaterally enlarged to fascicled cilia at least on outermost lobe, outside densely scaly, inside glabrous. *Petals* cuneate-obovate, 3.8–5.4 mm, deeply bilobed. *Stamens* 16–24 (usually without staminodes), subequal, in several bundles around the ovaries; *filaments* filiform, 0.9–1.2 mm, scarcely connate basally; *anthers* obloid, 0.8–1.2 mm long, abruptly constricted at apex and base, slightly incurved. *Pistils* 2; ovaries broadly obovoid, each with 2 basal ovules, densely scaly, with style attached to dorsal apex then curved up-, out- and again inward to place the constricted stigma above the apex of the anthers. *Fruiting peduncles* scarcely elongating, recurved. *Seeds* obovoid to almost spherical, 2.4–2.6 × 2.1–2.5 mm, black to brown, *aril* with a basal fleshy attachment extending into a cup-like sheath (scarcely lobed) covering the basal third of the seed. *Flowering*: February–August. **Figs. 1G & 10A–H.**

Distribution and ecology. Grows on sandy slopes more or less associated with sandstone rocks, found in *Eucalyptus* or rarely *Allosyncarpia* forest/woodland and mainly on the lower slopes of the western escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Locally common.

Diagnostic features. A very variable species with leaves often showing several stages of development (cf. type specimen), each of which is retained for a longer or shorter time. This and some of the following characteristics that usually identify the species are often absent on specimens: pyriform buds with erect hirsute outer calyx lobes overtopping rounded inner ones, short stout peduncle, soft erect-spreading hairs on leaves and branches, hairs with 1 (–3) antrorsely elongated arms on the upper leaf surface, and some scattered stalked fascicled hairs on branches and/or undersurface of leaves.

Although very similar to *H. solanifolia*, *H. alopecota* is distinguished by its very short peduncle, usually much smaller leaves, ovate to elliptic, rarely elliptic-oblanceolate bracts and fewer, smaller stamens. Some forms of *H. oblongata* have a similar decumbent habit as well as a similarly structured tomentum, but *H. alopecota* is mainly distinguished by its strongly elongated and woody receptacle (the reason for the obviously pyriform fruiting buds), but also by its distinctly overtopping outer calyx lobes. The more erect habit, and leaves of *H. oblongata* are usually oblong to elliptic (usually 3–5, rarely 7, times longer than broad).

Variation. This is the only species in northern Australia where the larger hairs are not only broad-based but that broad base is often more or less stalked, a phenomenon also typical for *H. hermanniifolia* in south-eastern Australia. Unusual for this species, and also *H. tridentata*, is the presence of one, rarely few, very much more elongated arms of the hairs on the upper surface of the leaves, while in other groups unequally branched hairs usually have a few very much shorter arms.

Hibbertia alopecota is an extremely variable species and some local forms can be recognised. The shape of the leaves and bracts divide the species into two groups, namely those with ovate and elliptic ones. The former are usually more densely hairy with arms mainly erect (type), while the latter usually appear less hirsute, because the individual arms of the hairs are spreading to almost reflexed, but not more or less appressed as in *H. auriculiflora*. The ovate leaves of the typical form usually have the two lateral teeth on the upper third which persist for a long time on adult plants, they vary from ovate to almost rhombic to broadly elliptic, and often display an almost complete reticulum of veins with raised laterals (often at ± right angles) and sinuate intramarginals at least on the undersurface. The elliptic leaves of the second type of plants normally have a tooth on either side of above the middle and these teeth are restricted to the juvenile leaves and they vary little in shape. The little raised lateral vein (at acute angles) and the only slightly sinuate intramarginal veins are often incompletely visible. In spite of all these differences in extreme forms, recombinations of these characters in different populations are common, so that these often local forms can not be clearly separated. It could not be established without doubt, which of these characters are due to different stages in the development of the plant and were possibly retained due to special environmental conditions, or which characters were permanent retensions of juvenile character(s) specific to that local population. For instance, it would seem that the lobes of leaves on adult plants were ultimately lost in some plant in exposed positions (*H.R.Toelken 9470*). Observations on a wider range of material are needed particularly from the area just north of Koongarra area, from where much variation has been recorded.

Etymology. The pyriform buds borne on a short peduncle hidden in the axil of leaves each have two prominently longer hairy outer calyx lobes above the rounded inner ones providing the allusion of "fox-ears" Greek, "alopecota" (noun in apposition, nominative plural).

Selection of specimens examined (33 seen)

NORTHERN TERRITORY: *K.G.Brennan 221*, Koolpin Gorge, 26.iii.1990 (DNA); *K.G.Brennan 721*, Saddle Ridge, Pallette outlier, 15.viii.1990 (DNA); *K.G.Brennan 5748*, N. Gudjekbinj Outstation, 30.viii.2002 (DNA); *I.D.Cowie 8760*, ca 73 km SSW Maningrida, 24.iii.2000 (DNA); *L.A.Craven 5709*, near Koongarra Saddle, 22.v.1980 (CANB, DNA); *L.A.Craven 5915*, 12 km SW Twin Falls, 25.vi.1980 (CANB, DNA); *L.A.Craven 6373*, 26 km S Cooinda, 5.vi.1980 (CANB); *L.A.Craven & G.M.Wightman 8390*, headwaters of Liverpool River, 4.iv.1984 (CANB, DNA); *D.L.Jones 1463*, Lightning Dreaming, 22.ii.1984 (DNA); *M.Lazarides 8903*, Koongarra Saddle, 22.vi.1980 (CANB, DNA, MEL); *G.J.Leach 2822 & I.D.Cowie*, near Kurundie Creek, 20.iv.1990 (AD, BRI, DNA); *G.L.Leach 4361 & L.Greschke*, headwaters of Koolpin Creek, 20.iv.1995 (DNA); *P. Martensz & R.Schodde A578*, 2-3 miles N. El Sharana, 25.i.1973 (CANB, DNA); *J.Must 1119*, Nourlangie Rock area, 22.vi.1973 (CANB); *M.O.Rankin 1978*, Koongarra area, 19.iv.1979 (CANB, DNA); *J.Russell-Smith 10339*, Mt Brockman area, 30.iii.1995 (DNA); *A.V.Slee & L.A.Craven 2747*, 6.5 km NE El Sharana, 22.iv.1990 (AD, CANB); *I.R.Telford 7865 & J.W.Wrigley*, 2 km Koongarra to Jim Jim road, 20.vi.1980 (CANB).

21. *Hibbertia tridentata* Toelken, *sp. nov.*

A H. circulari *bracteis et lobis externis calicis lineari-lanceolatis foliisque paribus pluribus venarum lateralium; a* H. orbiculari *bracteis et lobis externis calicis lineari-lanceolatis floribusque axilaribus differt.*

Typus: Northern Territory, c. 67 km S Maningrida, *I.D.Cowie 8668*, 19.iii.2000 (holo.: DNA; iso.: AD; B, CANB, MEL – *n.v.*)

Hibbertia sp. Mann River (I.D.Cowie 8668): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Perennial with prostrate branches up to 0.6 m long, little branched; wiry branches terete with slightly raised leaf bases but usually scarcely ridged, irregularly hirsute. *Vestiture* persistent or rarely wearing off, with spreading to erect rosette-like broad-based (rarely thin-based) fascicled hairs on vegetative parts of the plant and/or with ciliate narrow-rimmed scales on calyx and/ovary; *on branches* ± dense, with scattered larger erect rosette-like broad-based, often ± stalked fascicled hairs (3–9 unequally long arms) over smaller usually reflexed ones (7–10 usually subequal arms); *on leaves above* sparsely to moderately dense, with subequal erect-spreading rosette-like broad-based fascicled hairs (with 1 (–3) erect usually much longer arms and 6–9 shorter often subequal spreading to reflexed ones); *on leaves below* dense to very dense, with scattered larger, often ± stalked erect-spreading rosette-like broad-based fascicled hairs (9–16 unequal arms with most of them being longer) usually associated with veins or on the margins over shorter spreading to reflexed rosette-like broad-based fascicled hairs (7–14 unequal to subequal arms); *on bracts* above sparse, with smaller hairs towards the base, below with scattered erect-spreading, often almost stalked rosette-like broad-based fascicled hairs (5–9 subequal arms) sometimes antrorse; *on outer calyx lobes* outside very dense, with scattered larger erect-spreading rosette-like broad-based fascicled hairs (5–9 subequal arms) some of which are unilaterally enlarged mainly along the margins and on central ridge over smaller reflexed rosette-like to cactiform broad-based fascicled hairs or ciliate narrow-rimmed peltate scales, inside with scattered spreading rosette-like broad-based fascicled hairs, rarely cactiform fascicled hairs to ciliate narrow-rimmed peltate scale on the upper half; *on inner calyx lobes* outside very dense, with ciliolate narrow-rimmed peltate scales overtopped by ± scattered spreading rosette-like broad-based fascicled hairs mainly along the central ridge, without cilia on the membranous margins, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.3–1.1 mm long; *lamina* obovate to triangular-rhombic, (9.8–) 12.5–16 (–17.4) × (7.3–) 9–12 (–13.4) mm, hirsute apex with 3 (4) shallow teeth or lobes, gradually constricted into the petiole, often cuneate, flat, above ± grooved along the central vein but scarcely so on the two lateral ones and sparsely hirsute, below with raised central and lateral veins each ending in apex of teeth/lobes and more densely hirsute than above, discolourous; juvenile leaves not seen. *Flowers* 1 (2), "axillary", with rudimentary leaves or short short shoots, along the upper branches, with buds ± spherical; *peduncle* thread-like, 4.4–10.8 mm long, terete and slightly broadened below the flower; *bracts* linear-lanceolate to -elliptic, 2.6–3.5 × 0.6–1.0 mm, half to longer than outer calyx lobes, ridged, sparsely hirsute above and below. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate rarely linear-lanceolate, 5.2–6.1 × 1.8–2.3 mm, distinctly longer than inner ones, pointed, ridged above, outside ciliate-scaly overtopped by larger fascicled hairs and with unilaterally enlarged cilia along the margins, inside stubble-like to sparsely hirsute with cactiform and rosette-like fascicled hairs on the upper half; *inner calyx lobes* (3) ovate to obovate, 2.9–3.4 × 2.4–2.7 mm, obtuse to rounded, scarcely ridged, outside ± densely scaly overtopped by ± fascicled hairs along the central ridge, surrounded by a membranous margin without cilia, inside glabrous. *Petals* oblong-oblanceolate rarely obovate, 2.4–3.1 mm long, scarcely bilobed. *Stamens* 18–20 (without staminodes), subequal, around the ovaries; *filaments* filiform, 0.6–0.8 mm long, scarcely connate basally; *anthers* obloid, 1.1–1.3 mm long, abruptly constricted above and below, ± straight. *Pistils* 2; *ovaries* broadly obovoid to almost spherical, each with 2 basal ovules, ± densely ciliate-scaly, with styles attached to the upper outer edge of the ovary then curved up- and slightly outwards and again inwards so that the delicate end of the style and stigmas are situated just above the apex of the anthers. *Fruiting peduncle* elongating, recurved. *Seeds* obloid-obovoid, 2.7–2.8 × 2.4–2.6 mm, black; *aril* with fleshy attachment extended into a cup-like sheath (slightly lobed) covering the lower half of the seed. *Flowering*: March. **Figs. 2B & 10I–L.**

Distribution and ecology. Grows in sandy soil associated with sandstone scree amongst *Triodia* in heath-like scrub adjacent to *Allosyncarpia* forest Arhem Land, Northern Territory (A).

Conservation status. Rare and known only from one locality.

Diagnostic features. The sparse tomentum and long filiform peduncles are shared with *H. circularis,* which is distinguished by its ovate bracts and outer calyx lobes, the rounded teeth on juvenile leaves, and, more importantly, several pairs of lateral veins and usually the intramarginals are clearly visible. The sparse large erect-spreading hairs of *H. tridentata* are reminiscent of those of *H. orbicularis*, but that species is easily distinguished by its terminal flowers (leaf-opposed), even sparser and more widely distributed hairs, there are usually two pairs of lateral veins, if visible, and the bracts are ovate.

Note. The very delicate upper end of the style and terminal stigma usually just emerge from under the cluster of anthers and are reminiscent of those observed in the *H. aspera* group (*Hibbertia* sect. *Pleurandra*; Toelken 1998), probably suggesting a similar pollination syndrome.

Etymology. The epithet "tri-dentata", Latin, "3-toothed" refers to the leaves with usually three distal teeth.

Specimens examined

NORTHERN TERRITORY: *D.L.Jones 1463*, Lightning Dreaming, 22.ii.1984 (CANB, DNA); *R.A.Kerrigan & J.A.Risler 769*, first gorge of Magela Creek, 16.iii.2004 (DNA, DREF).

22. *Hibbertia solanifolia* Toelken, *sp. nov.*

A H. alopecota *pedunculis filiformibus, bracteis linearibus lobisque extimis incurvatis calicis differt.*

Typus: Northern Territory, Nourlangie Creek, *C.R.Dunlop 3384*, 22.ii.1973 (holo.: BRI; iso.: CANB, DNA, MEL, NSW).

Hibbertia sp. crenate (*C.R.Dunlop 3384*): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrub to 1 m tall, spreading to decumbent; branches strongly ridged (± triangular but not winged) from the centre of the leaf base, often coarsely hirsute. *Vestiture* persistent, with spreading to erect rosette-like broad-based (rarely thin-based) fascicled hairs on all vegetative organs, and with small scales ± overtopped by fascicled hairs on the calyx; *on branches* dense, with scattered larger erect rosette-like broad-based fascicled hairs (6–11 unequal arms with 1–3 obviously longer arms) over a range of smaller to really small spreading fascicled hairs (3–8 often hardly unequal arms); *on leaves above* moderate to dense, with few scarcely larger over smaller rosette-like broad-based fascicled hairs (4–8 subequal arms except for some larger hairs with unequal arms mainly towards the margins); *on leaves below* very dense, with spreading rosette-like often thin-based fascicled hairs (arms of individual hairs usually not visible) overtopped by larger scattered erect rosette-like broad-based fascicled hairs (8–12 usually unequal arms) particularly on the veins; *on bracts* below, similar to leaves, dense vestiture on lower surface and less dense above; *on outer calyx lobes* outside very dense, with narrow-rimmed peltate scales overtopped by larger erect to spreading rosette-like broad-based (rarely thin-based) fascicled hairs (8–15 unequal arms) or unilaterally enlarged cilia on the margins, inside glabrous or with few rosette-like fascicled hairs towards the upper margins; *on inner calyx lobes* very dense, with mainly narrow-rimmed peltate scales becoming smaller towards the membranous margins topped by scattered fascicled cilia, rarely erect-spreading fascicled hairs mainly along the central ridge, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* (0.8–) 2–5 (–8.2) mm long, distinct; *lamina* elliptic-oblong to elliptic-ovate or broadly elliptic, (18–) 25–45 (–68) × (11–) 15–30 (–37) mm, obtuse becoming rounded with hirsute cuspidate vein-end, ± abruptly constricted into petiole, flat, sinuate with (1–) 3, 4 (–6) ± shallow lobes on each side, above with central and some lateral veins slightly grooved and visibly lighter, shortly hirsute, below with raised central, ± lateral and often coarsely sinuate intramarginal veins ± visible, densely hirsute, discolourous; juvenile leaves obovate, with one or two (up to 6) shallow rounded teeth/lobes each with a lateral vein, but usually no intramarginals visible, similarly sparsely hairy on both surfaces with fine thin-based rosette-like fascicled hairs. *Flowers* "axillary", 1, rarely 2 with reduced leaves, along branches, with buds ± spherical or ellipsoidal when young; *peduncle* stiffly thread-like, (10.2–) 15–22 (–31.6) mm long, ± terete; *bracts* linear, 1.6–1.8 × 0.2–0.3 mm, acute to blunt, almost terete, below hirsute, above pubescent. *Calyx* with lobes unequal; *outer calyx lobes* (3/2) oblong-ovate to rarely -lanceolate, 4.1–4.5 (–5.6) × 3.5–3.9 mm, scarcely overtopping inner ones, acute to shortly acuminate, usually with central ridge, outside densely scaly overtopped by radial broad-based hairs mainly along the central ridge and with spreading unilaterally enlarged cilia along the margins, inside with peripheral hairs mainly near the apex; *inner calyx lobes* (2/3) oblong-obovate, 3.9–4.2 × 3.6–4.0 mm, ± rounded, rarely cuspidate, with membranous margins topped with few fascicled cilia, outside with central ridge hardly visible except for usually a row of ciliate-peltate scales (sometimes only ciliolate) overtopping very dense scales to both sides; inside glabrous. *Petals* obovate, 6.3–8.8 mm long, deeply bilobed. *Stamens* 34–38 (plus 0–4 staminodes), subequal, in groups around the ovaries; *filaments* thread-like, 1.8–2.3 mm long, scarcely connate basally; *anthers* narrowly obloid, 1.0–1.25 mm long, abruptly constricted above and below. *Pistils* 3; *ovaries* broadly ovoid, each with 2 basal ovules, densely scaly, with style attached to centrifugal apex and curved out-, up- and again inward to place constricted stigmas above the apex of the anthers. *Fruit peduncle* elongating, recurved. *Seeds* obovoid, 2.4–2.6 × 2.5–2.55 mm, black or almost so; *aril* with fleshy attachment extended into a short, slightly lobed cup-shaped sheath scarcely covering the base of the seed. *Flowering*: February–August. **Fig. 10 M, N.**

Distribution and ecology. Growing in crevices on sandstone outcrops in the centre of the western break-off of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Rare.

Diagnostic features. Although some of the leaves resemble those of *H. alopecota*, which also occurs nearby, *H. solanifolia* is very distinct from the former by its elliptic to almost spherical flower buds with the outer calyx not projected ear-like above it, the long thread-like peduncle and short linear bracts.

Variation. The very much larger leaves on young shoots have usually 4–6 major lobes on each side, and each has a visible vein-end. Sometimes these lobes have up to three teeth and only one with a vein-end. Smaller leaves usually on older branches have sinuate margins or are almost entire and with one or two obvious vein-ends. While the former have usually well developed lateral and coarsely sinuate intramarginal veins, the veins on the latter are usually incompletely visible on the lower surfaces of leaves.

Considerable variation in the denseness of the vestiture was observed on the few specimens examined.

Etymology. The epithet "solani-folia" Latin, "Solanum-leaved" refers to the sinuate to lobed leaves of this species, which are similar in shape to some native Solanum species.

Specimens examined

NORTHERN TERRITORY: *K.G.Brennan 5749*, N Gudjebinj outstation, 30.viii.2002 (DNA); *L.A.Craven & G.M.Wightman 8251*, head of gorge between Twin Falls and Jim Jim Falls, 23.iii.1984 (AD, CANB); *D.T.Liddle 1560 & Dempster*, tributary of East Alligator River, 20.vi.1996 (DNA); *I.R.Telford 7798 & J.W.Wrigley*, Little Nourlangie Rock, 20.iv.1980 (AD, CANB); *H.R.Toelken 9471*, Little Nourlangie Rock, 18.v.2004 (AD, CANB, DNA).

23. *Hibbertia circularis* Toelken, *sp. nov.*

Hibbertiae alopecota *et* H. tridentatae *similis sed alabastris sphaericis, calicis lobis externis bractiisque brevioribus rotundatis adpressis differt.*

Typus: Northern Territory, c. 18 km SE Mt Howship, *I.D.Cowie 8489*, 15.ii.2000 (holo.: DNA; iso.: AD)

Hibbertia sp. globular (*J.Brock 774*): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Perennial with prostrate or trailing branches up to 0.4 m long, little branched; branches slightly ridged from the centre of the leaf base soon becoming terete, sparsely and often irregularly hirsute. *Vestiture* persistent, with erect to spreading rosette-like broad-based (rarely thin-based particularly on juvenile leaves) fascicled hairs on branches, leaves and bracts, and mainly narrow-rimmed scales on calyx; *on branches* sparse to dense, with erect-spreading rosette-like usually broad-based fascicled hairs (3–7 unequal arms, scattered larger hairs usually with extremely unequal arms); *on leaves above* dense, with ± randomly distributed larger and smaller rosette-like usually broad-based fascicled hairs (5–8 unequal or subequal arms), or towards the margins with scattered obviously larger broader-based ones (8–11 often subequal arms); *on leaves below* very dense, with scattered mainly spreading larger rosette-like broad-based fascicled hairs (7–10 unequal arms) mainly along the veins and margin over a range of smaller ones (6–8 unusually subequal arms) ranging from spreading to reflexed or appressed as they decrease; *on bracts* above glabrous except for a few antrorse thin-based fascicled hairs on the upper third, below dense, with scattered cactiform broad-based fascicled hairs overtopped by scattered large spreading very broad-based rosette-like fascicled hairs particularly unilaterally enlarged ones towards the margins; *on outer calyx lobes* outside very dense, with ± subequal narrow-rimmed peltate scales and fascicled cilia as well as unilaterally enlarged fascicled hairs (both with unusually long arms) along the margins, inside puberulous to pubescent with few antrorse thin-based fascicled hairs; *inner calyx lobes* outside very dense, with subequal narrow-rimmed peltate scales becoming smaller towards the margin and with fascicled cilia on the narrow indistinct membranous margins, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* (0.4–) 0.8–1.5 (–2.3) mm long; *lamina* broadly elliptic to rarely broadly elliptic-obovate or almost orbicular, (9.2–) 15–25 (–29.6) × (9.1–) 15–21 (–24.3) mm, obtuse to rounded often becoming truncate or rarely shallowly emarginate, with vein-end shortly hirsute, upruptly constricted into distinct petiole, entire or rarely with one tooth (with vein-end) on upper third of each side, flat, above scarcely grooved along the central vein and pubescent hirsute, below with slightly recurved margins and raised central and ± visible laterals (rarely more than 6) and sinuate intramarginal veins, rarely with full reticulum, pubescent rarely sparsely hirsute, discolourous; juvenile leaves sometimes produced for a long time (*J.Brock 774*), broadly elliptic-obovate with one blunt tooth on upper third of each side, sparsely hirsute with scarcely broad-based fascicled hairs. *Flowers* 1 or 2 (3), "axillary", rarely with rudimentary leaves, along branches, with successive flowers in each axil often produced at long intervals, with buds ± spherical; *peduncle* thread-like, (4.6–) 10–15 (–17.6) mm long, almost terete; *bracts* broadly depressed-ovate, 1.1–1.6 × 1.5–2.1 mm, ca half as long as the outer calyx lobes, rounded to cuspidate, with auriculate to clasping base, with faint ridges, above glabrous to puberulous on upper third, below stubble-like with cactiform fascicled hairs overtopped by large rosette-like hairs and with spreading unilaterally enlarged cilia along the margins. *Calyx* with lobes unequal; *outer calyx lobes* (2) depressed broadly oblong-ovate to almost orbicular, (2.1–) 2.2–2.5 (–3.2) × (2.6–) 3.2–3.8 (–4.1) mm, more than half as long as inner ones, cuspidate to rounded, without ridges, outside densely scaly and with long unilaterally enlarged cilia, inside glabrous except puberulous to pubescent on upper third; *inner calyx lobes* (3) broadly obovate, (2.8–) 3–3.3 (–3.8) × (2.4–) 2.8–3.8 (–44) mm,

rounded, without ridges, outside densely scaly and with long delicate unilaterally enlarged and fascicled cilia on indistinct membranous margins; inside glabrous. *Petals* obovate, 3.8–5.6 mm long, ± deeply bilobed. *Stamens* 30 (with 3, 4 staminodes), subequal, in groups around the ovaries; *filaments* terete, 0.8–1.0 mm long, scarcely connate basally; *anthers* obloid, 1.0–1.15 mm long, abruptly constricted above (emarginate) and below, straight. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with style attached to the apex then curved up and outward to place the delicate stigmas well above the apex of the anthers. *Fruiting peduncle* often strongly elongating, recurved or nodding. *Seeds* (immature) broadly obovoid, 1.8–1.9 × 1.9–2.0 mm, brown; *aril* with fleshy attachment expanding into cup-shaped membrane (scarcely lobed) covering the lower third of the seed. *Flowering*: February, March. **Fig. 10O–Q**.

Distribution and ecology. Grows on sand between rocks on slopes with sandstone outcrops in *Eucalyptus miniata* woodland within dense scrub in the Upper East Alligator River region, western Arnhem Land, Northern Territory (A).

Conservation status. Unknown as known only from three collections.

Diagnostic features. Hibbertia circularis is very similar to *H. alopecota* and *H. solanifolia*, but is distinguished from the former by its thread-like peduncle several times the length of the flower and the almost spherical flower buds with the shorter outer calyx being appressed and subtended by almost orbicular bracts. The latter two species have usually shorter peduncles, but the pyriform flower buds are overtopped by longer spreading outer calyx lobes subtended by linear to linear-oblanceolate bracts. Even the tomentum differs mainly in the extreme variation in the length of the arms of the fascicled hairs.

Juvenile leaves are superficially similar to those of *H. tridentata* but flowers of *H. circularis* are easily distinguished by their more or less rounded short outer calyx lobes and bracts.

Almost round leaves are also found in *H. orbicularis*, but they are usually much smaller, have a different tomentum (especially in being less dense on the abaxial leaf surface), and flowers on short peduncles.

Variation. The leaves on some branches are more or less two-ranked presumably as a result of the prostrate branching. This might also explain why the peduncles of many of the fruit are not recurved as commonly found in these groups of hibbertias but are merely nodding below the fruit and most of the peduncle remains straight.

Etymology. The almost "round, circular" leaves are referred to in the epithet "circularis", Latin.

Specimens examined

NORTHERN TERRITORY: *J.Brock 774 & J.Russell-Smith*, Upper East Alligator River, 20.ii.1991 (DNA); *D.J.Dixon & G.J.Leach 1047*, ca 30 km NE Jabiru, 27.iii.2002 (DNA).

24. *Hibbertia tricornis* Toelken, *sp. nov.*

A H. alopecota *bracteis longioribus, alabastris floralibus circiter sphaeralibus, pedunculisque filiformibus; a* H. circulari *floribus solitaribus, bracteis longioribus, lineari-ellipticis lobisque calicis externis apicibus rotundatis differt.*

Typus: Northern Territory, Mt Brockman, *C.R.Dunlop 5047*, 7.xii,1978 (holo.: CANB 274082; iso.: BRI, CANB 274083, DNA, NSW; K – *n.v.*).

Shrublets to 0.2 m high, ± prostrate, little branched; delicate wiry branches sometimes rooting, slightly angular from the centre of the leaf base, sparsely hirsute. *Vestiture* persistent, usually larger over/with smaller spreading rosette-like broad-based fascicled hairs on branches, leaves and bracts, and with ciliate to entire scales on calyx; *on branches* moderately dense, larger with smaller spreading rosette-like broad-based fascicled hairs (5–8 ± unequal arms); *on leaves above* dense, with mainly larger interspersed with few smaller spreading rosette-like broad-based fascicled hairs (5–8 subequal arms, or with 1 or 2 longer ones) becoming scarcely larger towards the margins; *on leaves below* very dense, with larger spreading over smaller often reflexed rosette-like broad-based fascicled hairs (7–12 ± unequal arms); *on bracts* above sparser, moderately dense, the larger with smaller ± reflexed rosette-like broad-based fascicled hairs with fewer arms, below dense, the larger spreading over smaller ± reflexed rosette-like broad-based fascicled hairs (7–12 unequal arms) with some unilateral enlarged cilia; *on outer calyx lobes* outside very dense, with ciliate to entire narrow-rimmed scales overtopped by larger usually spreading rosette-like broad-based fascicled hairs (10–16 usually unequal arms), but fewer ones towards margins and mainly unilaterally enlarged cilia, inside moderately dense, with few larger and mainly smaller reflexed rosette-like broad-based fascicled hairs; *on inner calyx lobes* outside dense, with narrow-rimmed, rarely ciliolate scales and with unilaterally enlarged cilia on some parts but usually not on the broad membranous margins, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.7–2.2 mm long; *lamina* elliptic to broadly elliptic, (4.2–) 5.5–15.0 (–22.5) × (4.6–) 5–10 (–13.6) mm, rounded, rarely obtuse and with hirsute vein-end, usually abruptly constricted into petiole, flat, entire or rarely slightly undulate in upper third, above scarcely veined and sparsely tomentose, below with central, lateral (often not continued to the margin) and some intramarginal veins raised and densely tomentose to shortly hirsute, discolourous; juvenile leaves not seen. *Flowers* solitary, "axillary", and often with one rudimentary leaf on the basal axillary short shoot, with spherical (rarely slightly pyriform when fruiting) buds surmounted by slightly recurving apices of bract and two outer calyx lobes; *peduncle* filiform, (3.6–) 4.5–10 (–14.8) mm long, angular; *bracts* elliptic-lanceolate,

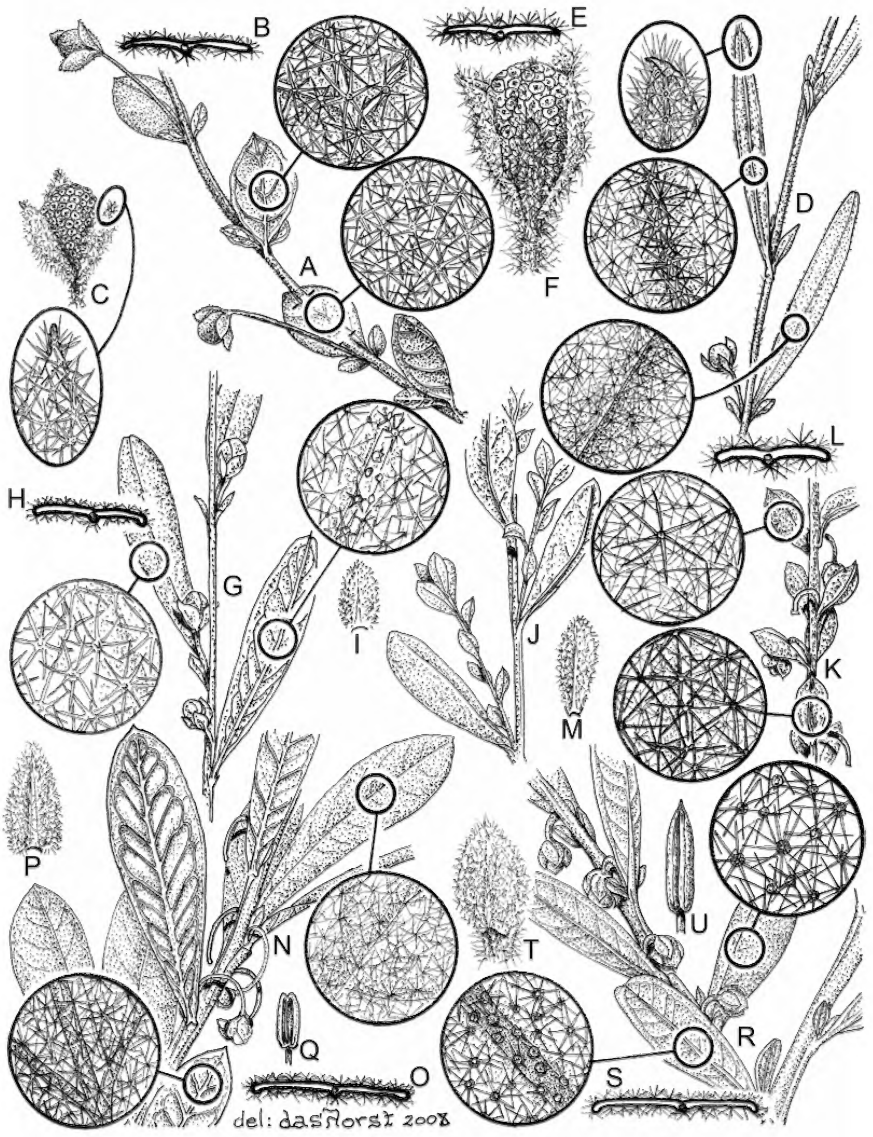


Fig. 11. A–C *H. tricornis*: A fruiting branch ×2; **B** transverse section through mid-leaf ×4; **C** bud ×2.5. **D–F *H. mollis*: d** fruiting branch ×1; **E** transverse section through mid-leaf ×4; **F** bud ×5. **G–U *H. oblongata* — G–I** subsp. ***oblongata*: G** fruiting branch ×1; **H** transverse section through mid-leaf ×2; **I** bract ×5. **J–M** subsp. ***brevifolia*: J** juvenile branch ×1; **K** mature fruiting branch ×1; **L** transverse section through mid-leaf ×4; **M** bract ×3. **N–Q** subsp. ***macrophylla*: N** fruiting branch ×1; **O** transverse section through mid-leaf ×2; **P** bract ×4; **Q** anther ×6. **R–U** subsp. ***megalanthera*: R** fruiting branch ×1; **S** transverse section through mid-leaf ×3; **T** bract ×3; **U** anther ×6. — **A–C** *C.R.Dunlop 5047*; **D–F** *P.A.Fryxell et al. 4688A*; **G–L**, *R.L.Specht 1370*, **J–M**; *P.A.Fryxell et al. 4906*; **N–Q** *M.Lazarides 9038*; **R–U** *P.A.Fryxell et al. 4902*.

2.6–3.5 × 1.05–1.35 mm, up to as long as and similar to outer calyx lobes, with acute apex spreading, above pubescent, below shortly hirsute to tomentose. *Calyx* with lobes unequal; *outer calyx lobes* (2) elliptic-oblanceolate, 3.5–3.8 × 1.8–2.0 mm, usually longer than the inner ones, acute, with distinct central ridge, outside scabrid with narrow-rimmed scales overtopped by larger unilaterally enlarged fascicled hairs and along the margins, inside reflexed-pubescent; *inner calyx lobes* (3) broadly oblong-obovate to almost orbicular, 3.4–3.6 × 2.4–2.8 mm, with rounded apex and membranous margins rarely with a few unilaterally enlarged cilia, outside densely scaly, inside glabrous. *Petals* cuneate-obovate, 7.6–8.9 mm long, deeply bilobed. *Stamens* 19–24 (without staminodes), subequal, in several bundles around the ovaries; *filaments* filiform, 1.0–1.3 mm

long, scarcely connate basally; *anthers* obloid, 0.8–1.1 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* ovoid to almost spherical, each with 2 basal ovules, densely scaly, with fine styles attached to apex then erect to slightly recurved but within the bunched anthers to slightly above them and incurved so that the delicate stigmas are positioned just above the apex of the anthers. *Fruit peduncle* often obviously elongating, ± recurved. *Seeds* broadly obovoid to almost spherical, 2.0–2.1 × 2.05 mm, brownish-black; *aril* with slightly fleshy basal attachment extending into a short cup-like sheath covering less than the lower third of the seed. *Flowering*: December. **Fig. 11A–C.**

Distribution and ecology. Recorded from "sand on scree of sandstone escarpment […] of Mt Brockman" on the central western escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Very rare.

Diagnostic features. Although *H. tricornis* is very similar to some forms of *H. alopecota* and *H. auriculiflora*, it differs from the latter two by its bracts being more or less as long as outer calyx lobes, the spherical buds (or they become only slightly pyriform when fruiting as opposed to their "snouted" pyriform to obconical ones), the thread-like peduncles, and by the whole plant being much more delicate and smaller in all respects. Therefore it closely resembles *H. circularis*, as both species have a prostrate habit and commonly broadly elliptic leaves, but *H. circularis* has usually more than one axillary flower, short almost orbicular bracts, and rounded appressed outer calyx lobes, which do not overtop the inner ones.

Variation. The flower buds are normally spherical but do become slightly pyriform when fruiting although the cuneate base is short and more or less concealed by the hirsute outer calyx, unlike those in *H. alopecota* and *H. auriculiflora*. In the fruiting stage the calyx lobes elongate somewhat while bracts seem to remain the same size, so that eventually bracts and calyx are distinctly unequal.

Etymology. In the flowering stage the bract is usually about as long as the two outer calyx lobes and, as all three are pointed and slightly curved outward they stand out above the spherical buds and with reference to this the epithet "tri-cornis", Latin, "three-horned" was chosen.

Specimens examined

The species is only known from the type collection.

25. *Hibbertia mollis* Toelken, *sp. nov.*

A H. alopecota *foliis et bracteis anguste oblongo-ellipticis; a* H. auriculiflora *pillis fasciculatis depressis vel adpressis differt.*

Typus: Western Australia, peninsula NE Frederick Harbour, *P.A.Fryxell, L.A.Craven & J.McD.Stewart 4688A*, 8.vi.1985 (holo.: CANB).

Shrubs to 0.4 m tall, little-branched, with long branches distinctly ridged, hirsute. *Vestiture* persistent, with rosette-like to cactiform broad-based fascicled hairs on branches and leaves, becoming ciliate narrow-rimmed peltate scales on bracts and outer calyx lobes to entire scales on inner ones; *on branches* moderately dense, with many erect rosette-like thin-based fascicled hairs (5–8 often very uneven erect arms) over a varying number of reflexed to spreading rosette-like, rarely cactiform, broad-based fascicled hairs (9–15 very uneven arms); *on leaves above* dense, with ± erect rosette-like ± broad-based fascicled hairs (2–5 unequally long erect arms); *on leaves below* very dense, with larger and smaller erect to spreading rosette-like broad- to thin-based fascicled hairs (5–11 slightly unequally long erect or spreading arms); *on bracts* above sparser, below dense, with spreading larger over smaller reflexed to cactiform broad-based fascicled hairs (16–22 unequal reflexed arms), rarely with unilaterally enlarged cilia; *on outer calyx lobes* very dense, with larger reflexed rosette-like broad-based fascicled hairs to ciliate peltate scales over smaller entire scales, and with unilaterally enlarged cilia on the margins; *on inner calyx lobes* very dense, with larger (rarely ciliolate-peltate) over smaller entire scales, with unilaterally enlarged to fascicled cilia along the margins. *Leaves* without axillary tuft of hairs, but often with densely hirsute axillary buds; *petiole* 0.3–1 mm long, densely hirsute; *lamina* narrowly elliptic-oblong, (22–) 25–40 (–53) × 4–8 (–11.2) mm, obtuse to truncate, with hirsute vein-end ± recurved, gradually tapering into petiole, entire, flat to shallowly boat-shaped with sometimes slightly recurved margins, above slightly grooved above the central vein and hirsute, below with raised but not broadened central vein as well as sometimes part of the intramarginal ones are visible and densely hirsute, somewhat discolourous; juvenile leaves not seen. *Flowers* 1, "axillary", with 1 or 2 rudimentary leaves, along branches, with buds about spherical with longer spreading outer calyx lobes; *peduncles* stiffly filiform, 4.2–5.6 mm long, scarcely compressed; *bracts* oblong-oblanceolate to almost strap-like, 3.6–4.2 × 1.7–2.1 mm, obtuse, flat, appressed, hirsute with some unilaterally enlarged cilia. *Calyx* with lobes unequal; *outer calyx lobes* (2) elliptic-oblanceolate, 7.2–7.5 × 2.0–2.3 mm, usually longer than inner ones, obtuse rarely bluntly acute, with ridges and slightly folded distally along the central vein, outside densely ciliate-scaly and with unilaterally enlarged cilia, inside with scattered erect thin-based fascicled hairs with 2 or 3 arms; *inner calyx lobes* (3) obovate, 4.4–4.8 × 3.8–5.0 mm, rounded with membranous margin topped mainly with marginal fascicled cilia, outside densely covered with appressed larger and smaller cilia, inside glabrous. *Petals* cuneate oblanceolate, 2.2–2.6 mm, emarginate. *Stamens* 24, 25 (without staminodes), subequal, in several bundles around the ovaries; *filaments* filiform, 2.4–2.6 mm long, scarcely connate basally; *anthers* narrowly obloid, 1.1–1.5 mm long, abruptly constricted

above and below. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with the styles attached to the central apex then curved out-, up- and again forward and slightly downwards so that the constricted stigma is situated a small distance above the apex of the anthers. *Fruiting peduncle* scarcely elongating, ± recurved. *Seeds* not seen. *Flowering*: June. **Fig. 11D–F**.

Distribution and ecology. Recorded from sandstone outcrop at the mouth of the Hunter River, Western Australia (Nk).

Conservation status. Very rare.

Diagnostic features. The narrowly oblong-elliptic leaves and the somewhat woody branches resemble species of the *H. oblongata* subgroup, but *H. mollis* was placed in the *H. alopecota* subgroup because of the soft hairs with long erect-spreading arms (these especially well developed on the abaxial petioles and the terminal vein-end of leaves), the very short peduncle, fewer than thirty stamens and its spreading decumbent habit. In all these characters it is most similar to *H. alopecota* and mainly distinguished from it by the oblong-elliptic leaves. It might also be confused with *H. auriculiflora* because of these slender leaves, but that species has reflexed hairs and the unilateral enlarged cilia are often scaly at the base, which is part of the reason why it was placed into the *H. lepidota* subgroup, the only group of species where this is common.

Variation. The tomentum on the branches varies considerably from dense and with mainly broad-based rosette-like fascicled hairs towards the base to fewer with most of their broad bases reduced to narrow-based on flowering branches.

Etymology. The hirsute tomentum of the specimens feels "softly hairy", Latin, "mollis".

Specimens examined

Known only from the type specimen.

2.4. *H. oblongata* subgroup

Vestiture: *leaves* with unequal spreading to reflexed rosette-like fascicled hairs or rarely scales with unequal arms (often longer antrorse and/or retrorse), particularly petioles with short spreading (tomentose) to appressed hairs, ± unilaterally enlarged to long single hairs on apical vein-ends, denser abaxially. *Calyx* with marginal unilaterally enlarged cilia. *Shrubs* with erect-spreading woody branches ridged to winged. *Leaves* flat, rarely slightly recurved, with central, lateral and intramarginal veins ± visible. *Flowers* "axillary", with ± spherical buds. *Anthers* (16–) 30–50 (–80), subequal, (0.7–) 1.1–1.3 (–2.3) mm long.

Diagnostic features. In contrast to the *H. alopecota* subgroup species of the *H. oblongata* subgroup have narrower, often more or less oblong leaves with hairs reflexed particularly on the abaxial surface of the petiole and vein-end. The expanded arms of the unilaterally extended cilia are more or less bunched and ray-like.

Content. Species 26–35. *H. brevipedunculata*, *H. oblongata*, *H. orientalis*, *H. suffrutescens*, *H. axillaris*, *H. caudice*, *H. rufociliata*, *H. cymosa*, *H. complanata*, *H. fractiflexa*.

Notes. Although most of the species are found in the Northern Territory, several extend their distribution range into, or rarely are restricted to Western Australia or Queensland.

The *H. oblongata* subgroup is very similar to the *H. alopecota* subgroup and at times not easily distinguished by their usually woody or multistemmed habit, their more or less oblong leaves and bracts, more or less reflexed fascicled hairs especially on the undersurface of the petiole (cf. Notes of *H. alopecota* subgroup) and usually more than 30 stamens. While the number of arms of marginal unilateral enlarged cilia of the *H. alopecota* subgroup are few and sparse, there are more arms in the *H. oblongata* subgroup, which form broad rays. The arms of these rays are not or hardly connate in contrast to those of the *H. lepidota* subgroup (cf. Fig. 1M).

Although *H. complanata* is superficially similar to *H. echiifolia* it does not have the characteristic tufts of hairs in the leaf axils and terminal clusters of flowers of the latter. In spite of its larger flowers, *H. complanata* is reminiscent of *H. fractiflexa*, and both have dissimilar scales to those of the *H. lepidota* subgroup, as they have small scales, mainly narrow-rimmed ones, on the petiole and the terminal vein-ends of leaves, and, more importantly, their leaves are flat in contrast to the incurved ones of the latter.

26. *Hibbertia brevipedunculata* Toelken, *sp. nov.*

A speciebus aliis Hibbertiae oblongatae *subturmae characteribus combinatis differt: habitu multicaule caudice, foliorum marginibus plus minusve recurvatis, pedunculis brevibus, alabastris plus minusve ellisoidalibus lobisque externis calicis rotundatis plus minusve adpressis.*

Typus: Northern Territory, Adelaide River area, *N.Byrnes 2489*, 26.i.1972 (holo.: NT; iso.: DNA; CANB, K – *n.v.*).

Hibbertia sp. A J.R.Wheeler, Fl. Kimberley Region 154 (1992), pro parte, excl. *H. suffrutescens*.

Hibbertia sp. Mt Finniss (S.T.Blake 16747): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrubs up to 0.6 m tall, multistemmed with woody rootstock, erect, usually little-branched stems; branches moderately ridged downwards from the leaf base, densely hirsute to tomentose or scaly. *Vestiture* persistent, with a full range from rosette-like fascicled hairs and/or narrow-rimmed ciliate-peltate and/or peltate scales on different parts of the same plant and/or different plants; *on branches* moderately to dense, with often much larger erect (7–12 often unequal spreading to erect arms) over small rosette-like broad-based fascicled hairs (6–15 subequal spreading to erect arms, often tufted) or rarely appressed ciliate-peltate/

peltate scales; *on leaves above* moderately dense, with scarcely larger and smaller rosette-like broad-based fascicled hairs (5–8 subequal usually reflexed arms), rarely with narrow-rimmed ciliate-peltate/entire scales, not in longitudinal rows (10–20 (–33) fascicled hairs/scales across the middle), not overtopping margins; *on leaves below* very dense, few scattered larger (7–12 subsequal erect-spreading arms) over felted smaller rosette-like broad-based fascicled hairs (6–10 subequal spreading arms) rarely narrow-rimmed ciliate-peltate/entire scales few of which sparsely overtop margins; *on bracts* above sparse, below like leaves but usually more densely covered with mainly narrow-rimmed ciliate-peltate scales; *on outer calyx lobes* outside dense to very dense, with larger (often ciliate-peltate) over smaller narrow-rimmed peltate scales ± overtopping margins but then those scales usually become ciliate unilaterally enlarged, inside glabrous or rarely with rudimentary fascicled hairs towards the apex; *on inner calyx lobes* outside very dense, with larger (sometimes ciliolate-peltate) over smaller peltate scales becoming smaller towards the membranous margins overtopped with at least some thin-based fascicled cilia, inside glabrous. *Leaves* without axillary tuft of hairs but often with hirsute axillary bud; *petiole* 0–1.2 mm long, indistinct; *lamina* linear, linear-elliptic to oblanceolate, (8.3–) 15–35 (–66.7) × (0.9–) 1.2–4.5 (–10.8) mm, acute to obtuse, often with terminal bristles of reduced unilaterally enlarged fascicled hairs, gradually tapering into base, entire, flat or sides ± folded upwards lengthwise but usually with ± recurved, rarely revolute margins, above grooved along the central vein and rarely intramarginals visible, sparsely hirsute to scaly, below with raised broad central vein, often straight intramarginals and sometimes partial lateral veins visible and usually more densely hirsute to scaly; discolourous; juvenile leaves (regenerating) entire, broader, flat with scarcely recurved margins and hardly developed central vein, all sparsely covered with rosette-like narrow- to broad-based fascicled hairs with at first few appressed but later more spreading to erect branches. *Flowers* 1, usually terminal on main branches, sometimes on short shoots or rarely "axillary" with reduced leaves, along upper part of branches; buds ellipsoidal to almost spherical; *peduncle* short and stout, 4–8 mm long, angular; *bracts* triangular-ovate to lanceolate or oblong-elliptic, 1.6–2.2 × 0.7–1.1 mm, acute to rarely pointed, often with terminal bristles, apex slightly recurved, densely ciliate-scaly and/or scaly. *Calyx* with lobes unequal; *outer calyx lobes* (2) broadly oblong-elliptic to -ovate or almost orbicular, 3.3–5.1 × 3.4–4.5 mm, up to two-thirds the length of inner ones, rounded to obtusely cuspidate, without ridge, outside densely scaly and with unilaterally enlarged cilia on the margins, inside glabrous or sometimes with rudimentary hairs towards the margins; *inner calyx lobes* (3) obovate-orbicular to oblong-obovate, 4.8–7.5 (-8.4) × 4.3–6.2 mm, rounded, with or without membranous margin, outside densely scaly and usually some fascicled cilia, inside glabrous. *Petals* broadly obovate, 7.4–15.7 mm long, ± deeply bilobed. *Stamens* 30–44 (without, rarely with up to 6 staminodes), subequal, in bundles around the ovaries; *filaments* ± thread-like, 1.1–1.6 mm long, scarcely connate basally; *anthers* narrowly obloid, 1.6–2.2 (–2.6) mm long, abruptly constricted above and below, ± incurved. *Pistils* 2; *ovaries* depressed ovoid, each with 4 basally lateral ovules, densely peltate, with style base attached dorso-laterally from where the style is curved out-, up- and again forward placing constricted stigmas laterally well above anthers. *Fruiting peduncle* scarcely elongating, ± recurving. *Seeds* not seen. *Flowering*: Mainly December–June. **Fig. 12A–J**.

Distribution and ecology. Grows in sandy to sandy-clay soil often associated with sandstone or granite, in eucalypt woodland in north-western Western Australia (NK) and central northern Northern Territory (A).

Conservation status. Locally common.

Diagnostic features. Most specimens of *H. brevipedunculata* were previously often identified as *H. cistifolia*, presumably because of its similar multistemmed habit, but it is distinguished by its subequal stamens, which are also found in *H. caudice*, another very similar species. The latter is, however, distinguished by less than thirty stamens, ovate, more or less clasping bracts and spherical flower buds. Even some plants of *H. brevipedunculata* are covered with large peltate scales, which closely resemble those of *H. lepidota,* but differ from the latter by their recurved leaf margins and rounded more or less appressed outer calyx lobes. Rarely other plants have scattered narrow-rimmed scales (e.g. *I.D.Cowie 1365 & R.Booth*) resembling those of *H. fractiflexa*, but this specimen is distinguished by its multistemmed erect habit, without basal short shoots on each stem, and with usually well over thirty stamens per flower.

Incomplete material without woody rootstock or the condensed base of stems can only be distinguished from plants of species such as *H. oblongata* by few or the sum of the following characters: by their regular and short side branches, the scarcely sinuate intramarginal vein, shorter peduncles and larger flower buds.

Variation. An extremely variable species with many local forms, but much of this variation must be attributed to developmental characters observed during the annual regeneration of the aerial shoots. This is particularly evident on collections from around the lower Adelaide River, which show considerable variation in the size and especially the width of the leaves as well as the vestiture, which ranges from rosette-like fascicled hairs with spreading to reflexed arms or ciliate to entire peltate scales. Further fieldwork is necessary to assess some local variants within this complex.

For instance, individual stems are usually wiry and little branched with the lower branches distinctly longer, while plants on the lower Finniss River and

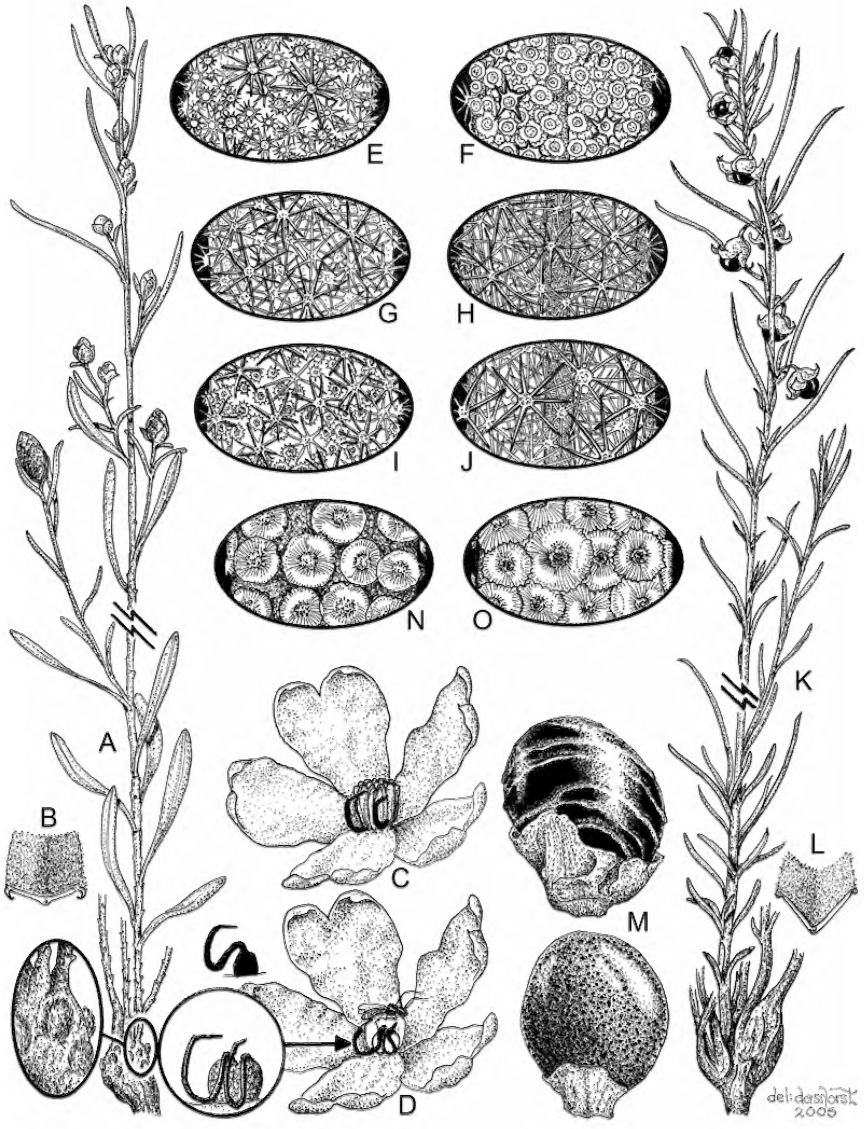


Fig. 12. **A–J *H. brevipedunculata***: **A** flowering branch with scales on rootstock ×1; **B** transverse section through mid-leaf ×4; **C** open flower ×4; **D** open flower showing curved styles ×4; **E–J** variation of vestiture on leaves in different areas: **E** adaxial hairs; **F** abaxial scales; **G** adaxial hairs; **H** abaxial hairs; **I** adaxial hairs; **J** abaxial hairs. **K–O *H. lepidota***: **K** fruiting plant regenerated after fire ×1; **L** transverse section through mid-leaf ×5; **M** seed variation ×10; **N–O** scales on leaves; **N** adaxial scales; **O** abaxial scales. — **A–D**, **I**, **J** *C.R.Dunlop 3126*; **E–F**, *N.Byrnes 2467*; **G**, **H** *I.D.Cowie 4547*; **K–O** *T.G.Hartley 14694*.

Cox Peninsula (*J.D.Briggs 803*) as well as a record from near Humpty Doo (*I.R.Telford 7438*) have stiffly woody stems with spreading lateral branches of about equal length all along them. These plants have fine erect rosette-like fascicled hairs and the narrow leaves have obviously recurved margins, while the fascicled hairs on leaves of plants from other areas are commonly spreading to reflexed.

Plants similar to the latter form from, for instance, east of Adelaide River (*G.Chippendale NT 6139*) are often covered with ciliate-peltate to peltate scales and their leaf margins are scarcely recurved.

Single flowers are usually terminal (i.e. becoming leaf-opposed if growth continues beyond this node) on main branches as well as lateral ones. Solitary terminal flowers are predominantly found on plants from Western Australia and in the form with rigid stems from the Cox River area. However, in other areas of the Northern Territory, the flowers vary from “axillary” on short shoots with very reduced leaves near the apex

of branches to solitary terminal on fully developed branches and leaves with one to several flowers on the lower lateral branches. The full range (see Fig. 12A) can at times be observed on the same branch on plants from the Northern Territory. The most common form here, however, is the slender "raceme-like inflorescence" with similar shortly stalked "axillary" flowers along branches.

Etymology. The epithet "brevi-pedunculata", Latin, "short-pedunculate" is self-explanatory though the effect is accentuated by relatively large flowers which sit almost clumsily among the slender leaves.

Selected specimens examined (82 seen)

WESTERN AUSTRALIA: *A.C.Beauglehole 51861*, King Edward River on Mitchell Plateau road, 1.vi.1976 (CANB); *A.C.Beauglehole 52216*, 30 km NW of Drysdale River crossing, 5.vi.1970 (CANB); *S.J.Forbes 2291*, 5 km N of Drysdale River crossing on Kalamburu road, 7.vi.1984 (CANB, MEL); *P.A.Fryxell & L.A.Craven 4051*, southern Mitchell Plateau, 11.v.1983 (CANB); *K.F.Kenneally 6739*, Mitchell Plateau, 20.vi.1978 (PERTH).

NORTHERN TERRITORY: *L.G.Adams 918*, George Creek, 21.iii.1964 (CANB, NT); *S.T.Blake 16713*, 5 km from Batchelor, 7.viii.1946 (AD, BRI, MEL); *J.D.Briggs 803*, 15 km NE Finniss River, 1.v.1983 (CANB); *J.D.Briggs 836*, Hayes Creek, 4.v.1983 (CANB); *N.Byrnes 2462*, Noonamah, 13.i.1972 (CANB, DNA, NT); *N.Byrnes 2467*, Mt Bundey, 18.i.1972 (CANB, DNA, NT); *G.Chippendale NT 6139*, 36 miles SE Adelaide River, 14.v.1959 (BRI, NSW, NT); *S.N.Cousins 55*, Bees Creek Road, 11.i.1979 (DNA); *I.D.Cowie 5188*, S Channel Island Road, 4.ii.1995 (AD); *P.A.Fryxell & J.McD.Stewart 4891*, Docherty Hills, 22.vi.1985 (CANB, DNA); *G.F.Hill s.n*, Batchelor, x.1913 (DNA, BRI, CANB); *M.Holtze NSW 225129*, Port Darwin, iii.1911 (NSW); *R.D.Hoogland 12670*, ca 2.5 km N Manton Dam turnof, 4.viii.1981 (CANB); *R.A.Kerrigan 675*, 300 m E of west Branch of West Alligator River crossing, 12.v.2003 (DNA); *J.R.Maconochie 616*, 43 miles S Darwin, 8.x.1968 (AD, CANB, NT); *J.McKean B165*, Manton River, 45 miles S Darwin, 8.xii.1971 (CANB, DNA, NT); *C.R.Michell & D.S.Calliss 443*, Lichfield National Park, 11.ii.1997 (DNA); *R.Pullen 9409*, Mt Bundey, 30.v.1974 (CANB); *W.F.Ridley 65*, Mt Burton, 28,iv.1967 (BRI); *C.S.Robinson 300*, Tipperary Station, 5.iii.1964 (NT); *R.Tate MEL 1579675*, crossing at Adelaide River, s.d. (AD, MEL); *I.R.Telford 7458 & J.W.Wrigley*, 2 km E Humpty Doo, 17.iv.1980 (CANB).

27. *Hibbertia oblongata* R.Br. ex DC.

Syst. Nat. 1: 431 (1817); Prodr. 1: 75 (1824); G.Don, Gen. Hist. 1: 76 (1831); Benth., Fl. Austral. 1: 30 (1863); F.Muell., Syst. Cens. 1: 2 (1882); Sec. Syst. Cens. 1: 2 (1889); Gilg, Nat. Pflanzenfam. 3, 6: 117 (1893); Ewart & Davies, Fl. North. Terr. 193 (1917); Gilg & Werderm., Nat. Pflanzenfam. 2 edn, 21: 26 (1925); Specht in Specht & Mountf., Rec. Amer.-Austral. Sci. Exped. Arnhem Land 3, 261, 400, 464 (1958); A.S.George & Kenneally, Wild. Res. Bull. West. Austr. 6: 53 (1977); Harmer, N. Austr. Pl. 1: 46 (1976); Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988); J.R.Wheeler, Fl. Kimberley Reg. 154, fig. 41D (1992); K.G.Brennan, Checklist Alligator Rivers Reg. 45 (1996); R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007. — **Typus**: Northern Territory, Groote Eyland, *R.Brown s.n.* [J.J.Bennett 4860], 15.i.1803 (holo.: G-DC; iso.: BM 551296, [K 75656, K 75663, MEL 666694 possible type, but see typification below]).

Shrubs to 1.5 m tall, usually erect to spreading; branches sharply ridged to winged, but soon becoming round and stiff-woody or rarely wiry, tomentose to stubble-like, rarely shortly hirsute. *Vestiture* persistent, rosette-like to cactiform broad-based fascicled hairs on branches and leaves, ciliate-peltate on bracts and mainly broad-rimmed peltate scales on the calyx; *on branches* moderate to dense with few larger spreading to erect rosette-like fascicled hairs mainly on the ridges (8–12 usually unequal arms) over dense shorter ones and/or cactiform broad-based fascicled hairs; *on leaves above* moderate to dense with spreading rosette-like broad-based fascicled hairs (5–8 subequal arms on main arms, but up to 12 and unequal towards the margins); *on leaves below* dense to very dense, with few scattered to many larger spreading to rarely erect (9–12 to rarely 16 sometimes unequal arms on the margins) over very dense smaller rosette-like broad-based fascicled hairs on the undersurface; *on bracts* above sparse, below dense, with few larger spreading rosette-like fascicled hairs over usually ciliate-peltate hairs and at least some spreading unilaterally enlarged marginal cilia; *on outer calyx lobes* outside with usually few ciliate-peltate scales towards the apex over dense entire scales with ± broadly spreading unilaterally enlarged marginal cilia, inside with fine erect usually rosette-like fascicled hairs on the upper third to half; *on inner calyx lobes* outside with larger and smaller peltate scales towards the membranous margin with or without fascicled cilia; inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0–2.6 mm long; *lamina* elliptic to oblong-oblanceolate, rarely oblong-ovate, (7–) 15–50 (–89.5) × (3–) 5–15 (–33.5) mm, acute becoming obtuse, truncate to emarginate, gradually or abruptly tapering into base/petiole, entire to shallowly lobed, flat, above faintly grooved along the central vein, pubescent to velvety, below with raised central vein and often sinuate intramarginals and laterals ± visible, shortly hirsute to velutinous, discolourous; juvenile leaves very large, oblong-oblanceolate, flat, with 1 subterminal or 2 teeth/lobes on the upper third of each side, sparsely hairy. *Flowers* 1 (–5), "axillary", along main branches and sometimes on lateral ones, rarely terminal on all branches, with buds spherical to pyriform with ± spreading apex of outer calyx lobes; *peduncle* short and sometimes stout, (2.1–) 5.5–10.8 (–22.3) mm long, angled to flattened; *bracts* elliptic, lanceolate- to ovate-oblong, (1.9–) 2.4–4.8 (–5.6) × (1.2–) 1.5–2.5 (–2.7) mm, acute to obtuse, not or scarcely ridged, outside densely scaly and with unilaterally enlarged cilia. *Calyx* with lobes unequal, *outer calyx lobes* (2) lanceolate-elliptic to oblong-oblanceolate,(4.9–) 5.5–6.5 (–6.9) × 2.2–3.2 (–3.6) mm, acute to usually obtuse, scarcely ridged, outside densely scaly with some unilaterally enlarged marginal cilia, inside pubescent on the upper half; *inner calyx lobes* (3) obovate-oblong, (4.5–) 4.9–6.2 (–6.6) × (3.1–) 3.5–4.2 (–4.4) mm,

rounded and with membranous margins sometimes with fascicled cilia, outside densely scaly, inside glabrous. *Petals* obovate, up to 13.7 mm long, bilobed. *Stamens* 16–36 (with or without staminodes), subequal, in several bundles around the ovaries; *filaments* filiform, (0.8–) 1.1–1.6 (–1.8) mm long, scarcely connate basally; *anthers* obloid, 0.7–3.2 mm long, abruptly constricted below and sometimes above, rarely pointed in subsp. *megalanthera*. *Pistils* 2; *ovaries* almost spherical, each with 2 basal ovules, densely scaly, with style attached to the centre then curved up-, back- and again inward so that the constricted stigma is situated above the anthers. *Fruiting peduncle* ± recurved. *Seeds* obovoid, 2.8–3.0 × 2.4–2.6 mm, black to dark brown; *aril* with fleshy attachment expanding into short scarcely lobed cup-shaped sheath covering less than a third of the base of the seed.

Diagnostic features. Hibbertia oblongata is a very variable species complex not easily distinguished by single characters. It has often been confused with *H. cistifolia* and, in particular, *H. caudice*, but these two species have a multistemmed habit with wiry decumbent branches, while this species has a single or few stiffly woody stems forming a spreading shrub usually 0.8–1.2 m tall. For similar reasons *H. suffrutescens*, a very similar Western Australian species, is distinguished from *H. oblongata*.

Variation. This very variable species has here been divided into four subspecies, and each of these has three more or less distinct stages in its development, which are particularly well illustrated by the size and shape of the leaves. Firstly, the large juvenile leaves with 1 (–3) teeth/lobes on each side of the leaf are not only found on seedlings but have also been recorded at the base of regenerating or suckering branches. Secondly, the extra-large leaves of fast growing branches (canes), the second stage, are similar to the former but entire and often larger. Thirdly, senescent branches, i.e. usually branches older than one year, have entire leaves three to five times shorter than the previous two. Flowers are often found in all three stages although they predominate on the senescent branches. In the case of subsp. *brevifolia* the foliage generally observed in the dryer Victoria Region of Northern Territory is presumably that of senescent branches, because the extreme conditions favours a quicker transition, while plants of the same subspecies from north-western Western Australia retain the longer more velvety leaves for longer periods. The senescent branches are, however, terminal on mature plants and consequently most commonly represented in herbarium material. The transition to other developmental stages is often incompletely documented and, although it would have been ideal to compare specimens of the same stage, this is rarely possible. More fieldwork and possibly population studies will hopefully clarify delimitation of the following four subspecies.

1. Specimens recorded from Groote Eylandt, the type locality of *H. oblongata*, are somewhat different from material known from most of the mainland of Northern Territory, because the leaves are more or less pointed with a prominent terminal tuft of simple hairs on the protruding vein-end; the leaves, especially above, are covered with reflexed broad-based rosette-like fascicled hairs with very short arms; the bracts are elliptic with a gradually tapering base; the outer calyx lobes overtop the inner ones, and, most importantly, the anthers are shorter, viz. (0.7–) 1–1.2 mm long, and very abruptly constricted into an often bilobed apex. The subsp. *oblongata* has mainly been recorded from the islands north-east and east of Arnhem Land as well as the adjoining mainland.

2. The description of subsp. *brevifolia* was based on an extreme senescent form with very short leaves from the upper Victoria River. The much broader concept here accepted includes all specimens of this species from localities west of the Adelaide River, and they have erect-spreading hairs on the upper leaf surface. A wider range of material would be needed to re-assess a number of local forms known from restricted areas within this region.

Although very small leaves are commonly found in subsp. *brevifolia*, they are also found on senescent plants in all the subspecies. However, there are a few specimens, which superficially resemble subsp. *brevifolia*, because they have petioled leaves with a spreading dense tomentum. However, they differ, because they are from the Arnhem Land Plateau, have basally truncate to auriculate bracts, more or less spherical buds with pointed outer calyx lobes, and 26–32 stamens with anthers 0.7–1.2 mm long. As they cannot be accommodated in any of the existing subspecies and have been recorded from widely separated localities they are here provisionally enumerated in the hope of obtaining more material for a better understanding of these form(s):

K.G.Brennan 2982, 60 km E Jabiru airstrip, 10.i.1995 (DNA); *K.G.Brennan & R.Harwood 3419*, Deaf Adder Gorge, 5.v.1997 (DNA); *P.Martenz & R.Schodde AE468*, 16 miles W El Sharana, 22.i.1973 (BRI); *A.V.Slee & L.A.Craven 2619* (AD) & *2659*, ca 4 km off El Sharana, 20.iv.1990 (AD, CANB); *I.R.Telford 7993 & J.W.Wrigley*, Deaf Adder Gorge, 22.iv.1980 (AD, CANB, DNA) see *I.R.Telford 8002 & J.W.Wrigley* under subsp. *megalanthera*).

3. Subsp. *macrophylla* has similar anthers and the whole plants are covered with erect-spreading hairs but they are shortly hirsute rather than the pubescent material of subsp. *oblongata*. In contrast to the latter the leaves of the former are much larger and usually abruptly constricted into a subsessile base (with petiole more or less absent), and, typically, subsp. *macrophylla* has more than 30 stamens.

4. The leaves of subsp. *megalanthera* are often similarly large to those of the former, but distinctly petiolate, while the anthers are often twice as long and

more or less drawn into a point. The latter two subspecies have both been recorded from the western escarpment of the Arnhem Land Plateau.

Typification. Candolle (1817) cited the type of *H. oblongata* as "in Carpentaria. Brown" and the holotype is inscribed "Carpentaria/ m Rob. Brown 1816". It was usually assumed that Candolle (1817) referred to the collection from Groote Eyland of 15 January 1803, which Brown used to describe the species in his manuscript, and this corresponds with a specimen (BM 551296) inscribed "No 33 desc/ Cistoides/ Carpentaria/ Groote Eyland/ Jany 15 1803". However, it bears the same number, J.J.Bennett 4860, as another sheet (BM 834630), which has a similar Brown field label reading "Cistoides/ N. Coast/ Island [Inglis Island]/ Febr 26 1803/ Fructicul bifid erect". In contrast to *H. echiifolia* (cf. typification) the author, Candolle in this case, refers only to "in Carpentaria", which must refer only to the one collection from Groote Eyland. Although it is therefore accepted that only specimens collected on Groote Eyland are type material, some of the isotypes mentioned (i.e. K 75656, K 75663, MEL 666694), which give only the species name and/or Bennett number, should be seen as doubtful isotypes. At present there is no means of distinguishing the two collections of *H. oblongata* made by R. Brown unless they have an original label stating its origin.

Key to subspecies

1. Bracts elliptic, elliptic-oblong, rarely oblong-lanceolate, constricted basally to subpetiolate; flower buds usually obovoid becoming pyriform with base scarcely broader than peduncle 2

2. Leaves discolorous; upper leaf surface with reflexed hairs with arms short, up to 2.5 times the diameter of the basal tubercle (epidermis usually showing between hairs) ..... 27a. subsp. ***oblongata***

2: Leaves not obviously discolorous; upper leaf surface with erect-spreading hairs with arms longer, 3–5 times the diameter of the basal tubercle (if shorter then tomentum very dense with no epidermis showing, mainly in WA) ..... 27b. subsp. ***brevifolia***

1: Bracts ovate to oblong-ovate, sessile and scarcely constricted basally to auriculate and ± clasping peduncle; flower buds spherical becoming obovoid, rarely pyriform but then with base distinctly broader than peduncle ... 3

3. Stamens 30–36; anthers obloid, (0.8–) 1.1–1.5 mm long; leaves sessile or almost so ... 27c. subsp. ***macrophylla***

3: Stamens 18–22 (–26); anthers ± conical, (1.6–) 1.8–2.6 (–3.2) mm long; leaves with petiole (0.4–) 0.8–1.5 (–2.4) mm long ..... 27d. subsp. ***megalanthera***

27a. *Hibbertia oblongata* subsp. *oblongata*

Benth., Fl. Austral. 1: 30 (1863); Chippend., Proc. Linn. Soc. NSW 96: 249 (1972).

Shrubs rarely up to 1 m tall, sparsely pubescent to stubble-like. *Leaves* with petiole (0.3–) 0.5–2 (–2.6) mm long, pubescent to velutinous; *lamina* elliptic to linear-elliptic, (7–) 15–40 (–68.5) × (0.2–) 4.5–15 (–25.2) mm, acute becoming obtuse, gradually tapering into petiole, sparsely covered with short-branched rosette-like broad-based fascicled hairs especially on the upper surface. *Flowers* single, "axillary" with rudimentary leaves; *buds* obovoid to pyriform; *peduncle* with cactiform to narrow-rimmed ciliate scales; *bracts* narrowly elliptic to oblanceolate, not auriculate and/or clasping. *Anthers* 18–22, obloid, 0.7–1.1 (–1.3) mm long, abruptly constricted into often bilobed apex. *Flowering*: November–August. **Figs. 1F & 11G–I**.

Distribution and ecology. Grows on sandy soil, but also often found in association with rock outcrops of mainly north-eastern Arnhem Land and especially on the off-shore islands, Northern Territory (A).

Conservation status. Locally common.

Diagnostic features. H. orientalis resembles most closely the typical subspecies but is here considered a distinct species mainly because of the greater number of stamens, its ciliate scales on the branches and the undersurface of the leaves, as well as its thread-like wiry branches, which are in contrast to those of subsp. *brevifolia* more or less winged. Furthermore its leaves are unusually narrow for subsp. *oblongata*.

Variation. As the fascicled hairs of the type from Groote Eyland have very short appressed arms on the upper surface of its leaves the epidermis below is clearly visible, while other specimens from other islands have hairs with longer spreading arms approaching sometimes the velutinous vestiture of plants from Western Australia. The best example is probably the right hand side specimen of *A.Cunningham 313a* from South Goulburn Island.

All these forms are distinguished from most plants on the mainland of the Northern Territory by smaller petiolate leaves and usually oblanceolate bracts (*Specht 427*: leaves 7–48 × 0.2–11 mm). Although quite a number of collection of subsp. *oblongata* from the Northern Territory have been examined none of these showed juvenile leaves with two to four serrations/lobes on the upper third, which has been commonly recorded for the other three subspecies.

Specimens examined

NORTHERN TERRITORY: *K.G.Brennan 2396*, The English Companys Islands, Astell Island, 2.ix.1996 (DNA); *I.D.Cowie 6049*, Wigram Island, 30.viii.1995 (DNA); *I.D.Cowie 8597*, ca 62 km SW Maningrida, 18.iii.2000 (DNA); *A.Cunningham 313a*, South Goulburn Island, x.1820 (K); *A.Cunningham s.n.*, Sims Island, 1818 (K); *F.Duncan 65*, 29 km upstream Buckingham River, 1.x.1975 (NT); *C.R.Dunlop 2643*, Bardalumba Bay, Groote Eylandt, 6.vii.1972 (DNA, NT); *P.K.Latz 2801*, 5 miles SW Goyder River crossing, 16.vi.1972 (NT); *G.J.Leach 3095*, English Company Islands, Cotton Island, 25.vii.1992 (AD); *G.J.Leach 3454 & C.R.Dunlop*, Bickerton Island, New Barge Landing, 29.iv.1993 (DNA); *J.R.Maconochie 2150*, Elcho Island, 8.vii.1975 (DNA, NT); *D.E.Murfet 4843*, Rainbow Cliffs, Nhulunbuy, 17.xii.2004 (AD, DNA); *R.Pullen 9503*, Nimbuwah Rock, 6.vi.1974 (CANB, DNA); *B.Rice 3104*, Nabarlek, 21.iv.1979 (CANB, DNA); *P.S.Short & C.R.Dunlop*

4820, Murwangi area, 2.ix.1998 (DNA); *J.Russell-Smith 2855*, 7 km SW Umbakumba, 21 vii.1987 (DNA); *J.Russell-Smith 5490*, Upper Coolpin Creek, 8.vi.1988 (DNA); *J.Russell-Smith 4013 & Lucas*, Upper Mann River, 7.xi.1987 (DNA); *J.Russell-Smith 4298 & Lucas*, Upper Walker River, 30.xi.1987 (DNA); *N.M.Smith 570*, Elcho Island, Galiwinku Community, 28.iv.1987 (DNA); *R.L.Specht 370*, Hemple Bay, Groote Eylandt, 5.v.1948 (CANB); *R.L.Specht 427*, Little Lagoon, Groote Eylandt, 28.v.1948 (AD); *R.L.Specht 640*, South Bay, Bickerton Island, 21. vi.1948 (CANB); *R.L.Specht 843*, Yirrkala, 8.viii.1948 (BRI, CANB); *D.E.Symon 7727*, near Goyder River crossing, 17.vi.1972 (DNA, NT); *J.Waddy 721*, Bardalumba, Groote Eylandt, 14.ii.1978 (DNA).

27b. *Hibbertia oblongata* subsp. *brevifolia* (Benth.) Toelken, *comb. & stat. nov.*

Hibbertia oblongata var. *brevifolia* Benth., Fl. Austral. 1: 30 (1863); Ewart & Davies, Fl. North. Terr. 193 (1917); Chippend., Proc. Linn. Soc. NSW 96: 249 (1972); R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007. — **Typus:** Northern Territory, Upper Victoria River, *F.Mueller s.n.* (lecto. – selected here: right specimen on K 75657; syn.: 2 specimens on left of K 75657, MEL 666695).

Hibbertia ?oblongata sensu A.S.George & Kenneally, Wild. Res. Bull. West. Austr. 6: 53 (1977), pro parte quoad *A.S.George 13564, 13748, 13834.*

Shrubs decumbent to spreading with wiry branches 0.3–0.6 (–1) m tall. *Leaves* with petiole (0–) 0.5–2 (–3.2) mm long, hirsute to velutinous but often wearing off; *lamina* elliptic, narrowly elliptic to elliptic-oblanceolate, rarely obovate (4.6–) 6–30 (–48.3) × (3.3–) 4–7 (–10.4) mm, acute to cuspidate, gradually tapering into petiole, finely hirsute to velutinous, ± densely covered with erect-spreading rosette-like broad-based fascicled hairs (arms usually 3–6 times longer than basal tubercle, or if shorter then very dense and from WA). *Flowers* single, terminal and rarely "axillary" or restricted to axillary branches; *buds* obovoid to pyriform; *peduncle* hirsute to velutinous; *bracts* narrowly elliptic, elliptic-oblong, rarely elliptic-lanceolate, subpetiolate. *Anthers* 16–20 (–26), obloid, 1.25–1.4 mm long, often mucronate. *Flowering*: February–August. **Fig. 11J–M**.

Distribution and ecology. Grows usually in sandy to skeletal soils associated with sandstone outcrops in eucalypt woodland or scrub in Western Australia (NK, VB) and Northern Territory (VR).

Conservation status. It is locally frequent although in places poorly collected.

Variation. Fundamental to the understanding of Bentham's *H. oblongata* var. *brevifolia* is its wide distribution covering many habitats with local variation in the Northern Territory as well as Western Australia. The shape of the leaves varies from the usual oblong or elliptic to linear (e.g. *M.D.Barrett 1803 & R.L.Barrett*) or even obovate (e.g. *M.D.Barrett 451*). However, the size differences of leaves is often perplexing as, for instance, *I.D.Cowie 5298* from a similar locality includes a branch with leaves 5.3–9.8 mm long as on the type, as well as a "fast growing branch" with leaves 20–26 (–28) mm long. But this is an unusual collection as the whole plant is covered with more or less ciliate scales instead of rosette-like fascicled hairs. M.O.Parker 907, although it has less extreme-sized leaves, it also exhibits these two growth forms as well as thin-based fascicled hairs on the "fast growing branch" and much broader based hairs, as on the type of var. *brevifolia*, on senescent branches. This form is mainly known from the Northern Territory but on some Western Australian specimens (e.g. *M.D.Barrett 2192, A.S.George 12598*) mainly cactiform hairs are found on the adaxial leaf surface but the rest of the plant is velvety to shortly hirsute. (The broad bases of these hairs are similar in size to those of *H. suffrutescens*, but in the latter most of the arms are reduced to teeth, i.e. most of the hairs are cactiform or rosette-like fascicled hairs with few or short appressed arms.) The leaves of the collection *C.T.Martens 813* from near Kalumburu, northern Kimberley, measure 6–48.3 mm, and have only small based fascicled hairs. The subsp. *brevifolia* as delineated here consists of numerous local variants, which can be combined into two major geographic groups: firstly the typical group from the Victoria Region of the Northern Territory, which has a shortly hirsute tomentum due to the longer erect-spreading arms (± 3–6 times as long as the diameter of the basal tubercle) of the fascicled hairs and usually comparatively short leaves; secondly, plants west of Kununurra usually have a shorter and much denser tomentum as the arms of most hairs are also erect. The hairs of a specimen collected ca 20 km west of the town (*T.Willing 451*) are somewhat intermediate between these two extremes, and also the tomentum of *A.S.George 13748* and *13834* from Drysdale River National Park are larger than characteristic for the western form. The latter specimen is a rare example of a specimen that exhibits a few distinctly axillary flowers, while the former has typical terminal flowers.

The specimen *I.D.Cowie 5298* from Spirit Hills Conservation area bears ciliate narrow-rimmed scales on the branches and both surfaces of the leaves, although it resembles closely other specimens of subsp. *brevifolia* from the same conservation area (*M.Jones 4*). This variant in contrast to *H. orientalis* was not given any taxonomic ranking because the presence of scales could not be connected with a second character.

Typification. Bentham (1863) cited under his *H. oblongata* var. *brevifolia* only F. Mueller's collection from the "Upper Victoria River" and two sheets of it were examined. The one in the Melbourne herbarium was initialled by Bentham, while he wrote "Hibb. oblongata, R.Br. var. brevifolia" in red pencil on the sheet in Kew. Both specimens are similar and bear blue labels of F. Mueller. The right specimen on the sheet at Kew was selected as lectotype, because it has a few more flowers.

Selection of specimens examined (44 seen)

WESTERN AUSTRALIA: *M.D.Barrett 451*, SW Edkins Range, 20.iii.1998 (PERTH); *M.D.Barrett 2192*, 4.3 km

SE of falls on King Edward River, 30 km N of new Theda Station homestead, 30.iv.2008 (PERTH); *M.D.Barrett 1803 & R.L.Barrett*, 18.8 km WNW Munja Airstrip, 19.i.2007 (PERTH); *G.W.Carr 3385 & A.C.Beauglehole 47163*, Cockburn Range, ca 6.5 km W King River, 10.vii.1974 (CANB); *S.J.Forbes 2178*, 17 km NNW Kalumburu Mission, 26.v.1984 (MEL); *P.A.Fryxell & L.A.Craven 4150*, near Drysdale River, 16.iv.1983 (CANB); *P.A.Fryxell, L.A.Craven & J. McD Stewart 4592*, Koolan Island, 2.vi.1985 (CANB); *P.A.Fryxell, L.A.Craven & J. McD.Stewart 4688B*, peninsula NE Frederick Harbour, 8.vi.1985 (CANB); *P.A.Fryxell, L.A.Craven & J. McD.Stewart 4830*, Joseph Bonaparte Gulf, 3 km upstream from Cape Whisky, 16.vi.1985 (CANB); *P.A.Fryxell, L.A.Craven & J. McD.Stewart 4851*, ca 14 km ENE Kalumburu, near Dominic Creek, 17.vi.1985 (CANB); *A.S.George 12598*, near Gariyeli Creek, Prince Regent River Reserve, 24.viii.1974 (PERTH); *A.S.George 13564*, near junction of Drysdale River and Mogurnda Creek, 8.viii.1975 (PERTH); *A.S.George 13748*, near Saba Falls, Drysdale River National Park, 12.viii.1975 (PERTH); *A.S.George 13834*, Coucal Gorge, 15.viii.1975 (PERTH); *T.G.Hartley 14659*, Durack River, 17.3.1978 (CANB); *A.J.M.Hopkins BA240*, Hidden Island, 18.vi.1982 (PERTH); *A.Hughan s.n.*, King Sound, (MEL 3x, NSW); *K.F.Kenneally 4368*, Woorakin Creek, 16.viii.1975 (CANB); *K.F.Kenneally 8448*, Gibbings Island, 22.vi.1982 (PERTH); *C.T.Martins 813*, near Kalumburu, date (AD, PERTH); *A.A.Mitchell & T.Willing 2413*, 10.iv.1992 (CANB); *L.J.Pen 92*, Cafferalli Island, 29.vi.1982 (PERTH); *D.E.Symon 7114*, Theda Station, 29.v.1971 (CANB); *T.Willing 451*, Molly Spring Creek, 19.vi.1991 (DNA).

NORTHERN TERRITORY: *N.Byrnes 713*, Kununurra Road, 7.v.1968 (NT); *G.W.Carr 2963 & A.C.Beauglehole 46742*, 3.5 km NE Victoria River Bridge, 5.vii.1974 (CANB); *I.D.Cowie 5298*, ca 2 km E Bucket Springs, 27.viii.1996 (DNA); *M.Jones 4*, Spirit Hills Conservation area, 26.viii.1996 (DNA) (scaly); *G.J.Leach & I.D.Cowie 4657*, Victoria River Gorge, 1.v.2001 (DNA); *M.O.Parker 907*, 8 km W Roper Bar, 22.vi.1977 (CANB, DNA, NT); *J.A.Risler & J.P.Burke 690*, West Arm, Gregory National Park, 7.v.2001 (DNA); *B.G.Thomson 980*, 3 km S Bullita Outstation, 8.ii.1986 (NT); *B.G.Thomson 1312*, Gregory National Park, 26.ii.1986 (NT); *G.Wightman 2768 & M.Clark*, Gregory National Park, 25.ii.1986 (CANB, DNA).

27c. *Hibbertia oblongata* subsp. *macrophylla* Toelken, *subsp. nov.*

A subspeciebus aliis foliis plus minusve sessilibus antherisque 30–36 differt.

Typus: Northern Territory, 4 ml N El Sharana, *P.Martenz & R.Schodde AE 507*, 23.i.1973 (holo.: CANB; iso.: BRI, NT; K – *n.v.*).

Shrubs often to 1.5 m tall. *Leaves* subsessile, with petiole 0–0.5 mm long, hirsute; *lamina* elliptic, rarely elliptic-oblanceolate, (18.3–) 25–50 (–89.5) × (7.2–) 10–20 (–28.8) mm, obtuse often becoming ± emarginate, usually abruptly constricted into base, densely covered with erect-spreading long-branched rosette-like fascicled hairs so that the not so broad bases are rarely visible. *Flowers* 1 (2), "axillary" with rudimentary leaves or rarely ± developed short shoots; *buds* spherical rarely becoming obovoid; *peduncle* with mainly erect-spreading fascicled hairs; *bracts* oblong-triangular, with auriculate and/or clasping base. *Anthers* 30–36, obloid, (0.8–) 1.1–1.5 mm long, apex abruptly constricted, ± bilobed. *Flowering*: January–July. **Fig. 11N–Q**.

Distribution and ecology. Usually associated with sheltered rock outcrops often in shrub vegetation or with *Allosyncarpia-Callitris* forest on the western escarpment of the Arnhem Land Plateau from near Oenpelli to Edith Falls, Northern Territory (A).

Conservation status. *M. Lazarides 9038*: "gregarious on shrubby sandstone plateau".

Variation. Leaves of actively growing or coppicing branches tend to have broad bases more or less clasping the stems, while the leaf bases of senescent branches taper more gradually downwards so that they are at times vaguely petiolate. Since the leaves of subsp. *megalanthera* are sometimes also almost sessile the anther characters should be given preference.

Etymology. As the leaves are often unusually large for a taxon in this group, the epithet "macro-phylla", Latinised Greek, "large-leaved" would be characteristic for this subspecies.

Specimens examined

NORTHERN TERRITORY: *N.Byrnes 818*, 8 miles N Mudginberry H.S., 18.v.1968 (NT); *L.A.Craven 6126*, 21 km N Jim Jim Falls, 29.v.1980 (CANB, DNA); *R.E.Fox 2551*, Deaf Adder Gorge, 24.ii.1977 (CANB, DNA, NT); *M.Lazarides 9038*, 17.5 km NNE Jabiru East, 28.v.1980 (CANB, DNA, MEL); *M.Lazarides 7799*, ca 35 miles SE Mudginberry H.S., 20.ii.1973 (NT); *P.Ollerenshaw 1592*, Edith Falls, 17.v.1975 (CANB); *R.Pullen 9463*, between Cahills Crossing and Oenpelli, 3.vi.1974 (CANB); *C.F.Puttock & J.T.Waterhouse 10298*, Jabiluka outlier, 30.vii.1980 (CANB); *J.Russell-Smith 1056*, 4 km N Ja Ja Camp, 2.ii.1984 (DNA); *I.R.Telford 7593*, 1 km E East Alligator crossing, 18.iv.1980 (AD, CANB, DNA); *J.Z.Weber 9850*, Jabaluka mining area, 21.v.1988 (AD); *J.Z.Weber 9903*, 10 km SW Oenpelli, 25.v.1988 (AD).

27d. *Hibbertia oblongata* subsp. *megalanthera* Toelken, *subsp. nov.*

A subspeciebus aliis antheris longioribus et ad apices gradatim constrictis foliisque gradatim constrictis ad bases differt.

Typus: Northern Territory, Katherine Gorge, *M.Lazarides 7034*, 8.iii.1964 (holo.: CANB; iso.: BRI, NSW, NT).

Shrubs rarely more than 1 m tall. *Leaves* with petiole (0.4–) 0.8–1.5 (–2.4) mm long, pubescent; *lamina* narrowly oblanceolate, elliptic-oblanceolate, (12.3–) 25–50 (–73.2) × (4.8–) 6–15 (–33.5) mm, acute becoming obtuse or truncate, rarely emarginate, gradually tapering into petiole, densely covered with ± reflexed to spreading, usually very broad-based fascicled hairs with moderately long arms. *Flowers* 1–3 (–5), "axillary" on ± developed short shoots; *buds* spherical to obovoid; *peduncle* usually with ciliate- to ciliolate-peltate scales and/or cactiform fascicled hairs all of which are usually overtopped by few spreading rosette-like fascicled hairs; *bracts* oblong-ovate to rarely -triangular, with slightly auriculate and/or clasping base. *Anthers* 18–22 (–33),

conical rarely becoming narrowly obloid, (1.6–) 1.8–2.6 (–3.2) mm long, gradually tapering into ± pointed apex. *Flowering*: Throughout the year, but less frequent in July and August. **Fig. 11R–U**.

Distribution and ecology. Grows on sandy soil usually associated with and often sheltered in large sandstone outcrops, frequently along creeks or ravines in eucalypt forest, woodland or shrubland along the western escarpment of the Arnhem Plateau, Northern Territory (A).

Conservation status. Locally frequent and conserved in Nitmiluk and Kakadu National parks, Northern Territory.

Variation. This subspecies is largely recognised by its longer anthers, which are tapering into a more or less pointed apex with poral dehiscence for some time and only later the lateral slits become visible. At that stage the anthers become slender-oblong.

This subspecies consists of two forms, the northern of which has been recorded from between Nabarlek to Pine Creek and El Sharana, while a another has often been collected from Nitmiluk National Park. Both of them have the typical conical anthers but these tend to be slightly shorter in the northern form and also up to five flowers develop on visible short shoots, while the flowers per leaf axil are reduced to one in the southern form or rarely two flowers with a few rudimentary leaves at the base of the peduncle are found. The two geographical forms are at times very close and it appears to be a stepped cline but without detailed information of the individual local variation the phenomenon cannot be fully evaluated.

An unusual specimen (*L.A.Craven & G.M.Wightman* 8375) with 33 anthers, each obloid and 1.2–1.35 mm long, from the headwaters of the Liverpool River was placed in this subspecies although it has a stubble-like tomentum on most parts of the plant and especially the peduncle.

Etymology. The anthers of this subspecies are often twice as long as those of the other three, so that the epithet "megal-anthera", Latinised Greek, "large-anthered" was adopted.

Specimens examined

NORTHERN TERRITORY: *L.G.Adams & M.Lazarides 3101*, ca 31 km ENE Goodparla Station, 26.ii.1973 (CANB); *L.G.Adams & M.Lazarides 3119*, ca 10 km SSE Mt Brockman, 27.ii.1973 (CANB); *Barnett & Azzopardi 15*, Mt Brockman, 22.ii.1977 (CANB, DNA); *N.Byrnes 64*, Katherine Gorge, 16.i.1967 (DNA, NT); *N.Byrnes 1327*, 44 miles NE Pine Creek, 30.i.1969 (DNA, NT); *N.Byrnes 2037*, Katherine Gorge, 21.i.1971 (CANB, DNA, NT); *N.Byrnes 2472*, 48 miles NE Pine Creek, Moline Road, 6.i.1972 (CANB, DNA, NT); *I.D.Cowie 2962*, Cotton Island, 28.v.1992 (DNA); *I.D.Cowie 5682 & K.G.Brennan*, upper catchment of Magela Creek, 2.iv.1995 (DNA); *I.D.Cowie 6903 & N.Scullion*, N end of Wigram Island, 2.v.1996 (DNA); *L.A.Craven 5751*, near Buffalo Springs, 22.vi.1980 (CANB, DNA); *L.A.Craven 6241*, 28.5 km W Twin Falls, 1.vi.1980 (BRI, CANB, MEL); *L.A.Craven & G.M.Wightman 8375*, Headwaters of Liverpool River, 2.iv.1984 (CANB); *C.R.Dunlop 4676*, Mt Brockman, 1.ii.1978 (CANB, DNA); *C.R.Dunlop 5675*, top of Jim Jim Falls, 30.i.1981 (BRI, CANB, DNA); *J.Egan 2168*, Bardedjdilidji Walk, 22.iv.1993 (DNA); *M.Evans 3540*, Nitmiluk above visitor centre, 28.xii.1990 (CANB); *R.J.Fensham 693*, 1 km upstream from Twin Falls, 20.iii.1988 (DNA); *D.A.Hearne 386*, 42 miles Pine Creek to El Sharana, 12.i.1973 (DNA); *D.L.Jones 1720*, Bowerbird Billabong, Magela Creek, 12.xii.1984 (CANB); *M.Lazarides 7759*, ca 26 miles E Oenpelli, 17.ii.1973 (CANB); *G.J.Leach 2808 & I.D.Cowie*, near Kurundie Creek, 20.iv.1990 (AD); *P.Martenz & R.Schodde AE 367*, El Sharana mining camp, 17.i.1973 (BRI, CANB, NT); *P.Martenz & R.Schodde AE468*, 16 miles W El Sharana, 22.i.1973 (CANB, NT); *M.O.Parker 615*, Batchelor area, 17.xii.1974 (DNA); *M.O.Rankin 2195*, 2 km N Nabarlek airstrip, 26.iv.1979 (BRI, CANB, DNA); *C.S.Robinson 330*, Katherine Gorge, 8.iii.1964 (NT); *J.Russell-Smith 3095 & Lucas*, 3 km NW Numbulwar, 1.ix.1987 (DNA); *I.R.Telford 8002 & J.W.Wrigley*, Deaf Adder Creek Gorge, 22.iv.1980 (CANB).

28. *Hibbertia orientalis* Toelken, *sp. nov.*

A speciebus e turma Hibbertiae oblongatae *ramis perangulatis vel alatis, paginis abaxillaribus foliorum tectis squamis ciliato-peltatis appressis, antherisque plus minusque 36 differt.*

Typus: Northern Territory, Sir Edward Pellow Group, White Islet, *D.V.McKey 146*, 11. v.1977 (holo.: DNA; iso.: NT).

Shrub to 0.5 m high, spreading; branches wiry, strongly angled to winged from the centre of the leaf base, with densely stubble-like tomentum. *Vestiture* persistent, rosette-like to cactiform broad-based fascicled hairs on vegetative organs and mainly peltate scales on calyx; *on branches* moderately dense, with scattered larger (9–15 subequal arms) over/with few to many cactiform, or rarely one-sided broad-based fascicled hairs; *on leaves above* moderately dense, scarcely larger over/with smaller reflexed rosette-like broad-based fascicled hairs (8–16 short subequal arms) but often all with subequally broad basal tubercle; *on leaves below* very dense, with usually several layers of larger over decreasingly smaller reflexed rosette-like broad-based fascicled hairs (6–18 usually short subequal arms) overtopped by ciliate scales; *on bracts* above and below dense, with ciliate-peltate scales and ± unilaterally enlarged marginal cilia/ciliate scales; *outer calyx lobes* dense, with larger and smaller, usually entire scales and usually broad unilaterally enlarged cilia along the margins; *inner calyx lobes* very dense, with larger over smaller peltate scales becoming smaller towards the membranous margins sparsely mainly overtopped by fascicled cilia. *Leaves* without axillary tuft of hairs; *petiole* 0.5–2 mm long, indistinct; *lamina* narrowly elliptic to elliptic-oblanceolate, (6.2–) 9–16 (–22.6) × (1.4–) 2.5–4.5 (–6.2) mm, abruptly constricted into a ± cuspidate apex with erect bristles of ± unilaterally enlarged appressed fascicled hairs, becoming rounded, gradually tapering into petiole, flat, entire, above scarcely grooved along the central vein and strigose, below with raised central vein, and slightly

recurved margins and densely appressed fascicled hairs, discolourous; juvenile leaves not seen. *Flowers* terminal on long and short shoots, with spherical buds; *peduncle* stiffly filiform, 4.5–9.3 mm long, strongly angled; *bracts* lanceolate, 2.5–3.3 × 1.9–2.4 mm, acute, appressed, not ridged, densely peltate above and below with unilaterally extended cilia along the margins. *Calyx* with lobes unequal; *outer calyx lobes* elliptic-lanceolate, 3.6–5.2 × 2.4–2.7 mm, usually slightly shorter than inner ones, acute, erect, faintly ridged towards the apex, outside densely peltate and with unilaterally enlarged cilia along the margins, inside densely stubble-like to fascicled-pubescent on upper half; *inner calyx lobes* oblong-obovate, 4.4–5.2 × 3.6–3.8 (–4.2) mm, rounded with membranous margins ± fascicled-ciliate, outside densely peltate, inside glabrous. *Petals* broadly obovate, 7.1–7.6 mm long, deeply emarginate to lobed. *Stamens* ca 36 (without staminodes), subequal, in several bundles around ovaries; *filaments* filiform, 1.0–1.3 mm long, often slightly connate at least in some bundles; *anthers* obloid, 1.1–1.3 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* obovoid to almost spherical, each with 2 basal ovules, sparsely peltate, with style attached to the apex curving back-, up- and then forward and down to place the constricted stigma above the anthers. *Fruit peduncle* recurved. *Seeds* broadly obovoid, 2.2–2.3 × 2.2–2.4 mm, black or brown; *aril* with short fleshy attachment enlarged into a scarcely lobed sheath covering the lower third of the seeds. *Flowering*: May. **Fig. 14F, G**.

Distribution and ecology. "Growing between rocks in sandy soil" on White Islet, Northern Territory (A).

Conservation status. Unknown.

Diagnostic features. A species superficially very similar to some forms of *H. oblongata*, but *H. orientalis* has strongly angular wiry branches, ciliate-peltate scales on the undersurface of leaves and about 36 stamens.

Variation. The tomentum on branches of this species is unusual in that most of the rosette-like broad-based fascicled hairs on different parts of the plant have very short arms, with arms only developed on one side of the hair, or the arms are reduced to papillae, i.e. cactiform broad-based fascicled hairs. A mixture of the various types, but often with a varying majority of one or other element on different parts, are usually found on different branches. Variation on different plants is therefore probable.

The specimen, *F. Mueller K 75654* (Albany Island [N.Qld], Aug. 1855), has scales similar to but not as obviously ciliate as those of the type of *H. orientalis.* It could not be definitively determined because no flowers were available. Its identity as *H. orientalis* would broaden the distribution of the species considerably.

Etymology. Being the easternmost record of a group of similar species explains the epithet "orientalis", Latin, "eastern".

Specimens examined.

Known only from the type collection.

29. *Hibbertia suffrutescens* Toelken, *sp. nov.*

Hibbertiae axillari *similis sed foliorum paginis adaxialis tectis pilis cactiformibus, bracteis breve triangularibus antherisque 30–36; a* H. brevipedunculata *alabastris floralibus sphaericis pedunculisque filiformibus longioribus; a* H. oblongata *pilis fasciculatis cum ramulis multis deminutis habituque decumbenti differt.* **Typus**: Western Australia, Kalumburu road, 174.4 km N Gibbs River road, *T.E.H.Aplin, R.J.Cranfield, B.L.Rye & J.R.Wheeler 898*, 2.v.1985 (holo.: PERTH 3097943; iso.: 3–4 duplicates).

Hibbertia sp.: A.S.George & Kenneally, Wildlife Research Bull. Western Austr. 3: 46 (1975), pro parte quoad *A.S.George 12598.*

Hibbertia tomentosa auct. non R.Br. ex DC.: A.S.George & Kenneally, Wildlife Research Bull. Western Austr. 3: 46 (1975), pro parte quoad *A.S.George 12544*; N.G.Marchant & Keighery, Kings Park Research Notes 5: 64 (1979), pro parte.

Hibbertia sp. A J.R.Wheeler, Fl. Kimberley Reg. 154 (1992), pro parte excl. *H. brevipedunculata.*

Shrublet to 0.3 m tall, with slightly woody rootstock and decumbent to prostrate wiry branches, each often with some erect short shoots; branches ridged from the centre of the leaf base, stubble-like. *Vestiture* persistent, with rosette-like to cactiform broad-based fascicled hairs on branches and leaves, but becoming scaly on peduncle, bracts and calyx; *on branches* dense to moderately dense, with cactiform fascicled hairs overtopped by few rosette-like broad-based fascicled hairs (7–12 unequally long arms); *on leaves above* dense, with rosette-like to mainly cactiform broad-based fascicled hairs (8–12 unequally long or only antrorse arms developed); *on leaves below* ± similarly to above but more densely covered with rosette-like (rare only on *A.S.George 12598*) to mainly cactiform broad-based fascicled hairs (7–12 unequal arms); *on bracts* below dense, mainly with ciliate-peltate scales except for unilaterally extended cilia along the margins, above with scattered papillae with few antrorse short unequal arms unlike cactiform fascicled hairs; *on outer calyx lobes* outside very dense, with narrow-rimmed scales and long unilaterally extended marginal cilia, inside with papillae often with a few antrorse hairs on the upper third; *on inner calyx lobes* outside very densely covered with narrow-rimmed scales and with ± fascicled marginal cilia, inside glabrous. *Leaves* without axillary tufts of hairs; *petiole* 0–0.5 mm long, indistinct; *lamina* narrowly oblanceolate, rarely linear-elliptic, (8.3–) 15–25 (–39.4) × (2.8–) 3–6 (–7.6) mm, with acute to shortly acuminate vein-end often recurved to hooked and with long unilaterally enlarged fascicled hairs, very gradually tapering into petiole, entire, with margins incurved to shallowly cymbiform, rarely flat, above with recessed central vein scarcely visible and stubble-like, below with raised central vein and rarely shallowly sinuate intramarginals visible close to the margins, stubble-like

almost as dense as above, scarcely discolourous; juvenile leaves (regenerating) oblanceolate and with ± rounded apex, flat, entire, with scattered to moderately dense (usually denser above than below) fascicled hairs with subequal arms. Flowers 1, "axillary", with or without rudimentary leaves of short shoots, along branches, with buds spherical; *peduncle* thread-like, (6.5–) 8–12 (–14.6) mm long, scarcely compressed to almost terete; *bracts* narrowly lanceolate to triangular, (1.5-) 1.7–2.0 × 0.8–1.1 mm, usually less than half the outer calyx, acute and appressed to distally spreading, ± ridged, below stubble-like to scaly with spreading fascicled hairs on the margin some of which are unilaterally extended, inside almost glabrous to some hairs distally. *Calyx* with lobes unequal; *outer calyx lobes* (2) broadly oblong to ovate, 4.05–4.4 (–4.5) × 2.1–2.7 (–2.9) mm, shorter than inner ones, rounded, scarcely ridged, outside very densely scaly and with long unilaterally enlarged marginal cilia, inside with few antrorse fascicled hairs and tubercles on the distal third; *inner calyx lobes* obovate to oblong-obovate, 5.6–6.0 (–6.2) × (3.2–) 3.5–3.9 mm, rounded, without ridge, outside very densely scaly except for narrow membranous margin with ± fascicled cilia, inside glabrous. *Petals* broadly obovate, 7.1–9.3 mm long, deeply bilobed. *Stamens* 30–36 (without staminodes), subequal, around the ovaries; *filaments* filiform, with papillose kink below anthers, 1.4–1.55 mm long, scarcely connate basally, *anthers* obloid, 1.5–1.7 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* obovoid, densely scaly, each with 2 basal ovules, with delicate styles attached to the apex then curved up-, out- and ± inward again so that the contricted stigmas are positioned well above the anthers. *Fruiting peduncle* slightly elongating, recurved. *Seeds* obovoid, 3.0–3.2 × 2.8–3.0 mm, black or brown; *aril* with fleshy attachment enlarging into a cup-shaped membrane (crenulate and not lobed) covering the lower half of the seed. *Flowering*: January, April, May. **Fig. 14J–L**.

Distribution and ecology. Grows on sandy soil overlaying sandstone or in rock crevices in eucalypt woodland, usually of *E. miniata* and *E. tetrodonta* in north-western Western Australia (NK).

Conservation status. Locally "frequent" (*T.E.H.Aplin et al. 898*).

Diagnostic features. Hibbertia sp. A. from the Flora of the Kimberley Region included two elements, namely this species and what is here described as *H. brevipedunculata*, from which *H. suffrutescens* is distinguished by its linear-oblanceolate leaves with slightly incurved margins, small almost spherical flower buds and longer, (6.5–) 8–12 (–14.6) mm long, thread-like peduncles. The distinctly unequal or reduced arms of hairs as well as wiry branches from a short rhizome and a delicate peduncle with small flower buds distinguish *H. suffrutescens* from *H. oblongata* subsp. *brevifolia*. A form of the latter variety has broad-based fascicled hairs with sometimes only few or no arms on the adaxial leaf surface (e.g. *A.S.George 12598*, *M.D.Barrrett 2192*), but the abaxial surface is, unlike that of leaves of *H. suffrutescens*, covered with a typical velvety to shortly hirsute tomentum. The whole plant of *H. suffrutescens* is mainly covered with cactiform hairs, or where there are few arms, they tend to be short and more or less appressed.

H. axillaris seemed at first a particularly robust form of this species, but that species is distinguished by the absence of short shoots on branches, the velutinous vestiture of the vegetative organs especially the upper leaf surface, linear-triangular bracts, and 42–50 stamens.

The multistemmed habit and the leaves closely resemble those of *H. cistifolia* and even coarser hairs particularly on the upper surface of the leaves are reminiscent of, yet not as robust as in that species, but *H. suffrutescens* differs by its smaller pyriform flower buds, subequal anthers and absence of scales on the style base.

Variation. The specimen *P.A.Fryxell et al. 4711* is here interpreted as belonging to this species with regenerating branches from the perennial rootstock, because the more or less appressed arms of the fascicled hairs decrease as well as the number of hairs particularly on the undersurface of the leaves increase acropetally. Rosette-like fascicled hairs are in contrast to the spreading hairs of H. *oblongata* subsp. *brevifolia* (cf. distinguishing features above) more or less appressed throughout and especially on the undersurface of leaves.

This different regeneration from few scattered appressed rosette-like hairs to dense cactiform hairs as well as a distinct rootstock from which decumbent wiry branches develop demonstrates closer resemblance to *H. caudice*. *H. suffrutescens* is a separate species and not an extreme development from forms of *H. oblongata* subsp. *brevifolia* as, for instance, the above discussion for *A.S.George 12598* might have indicated.

Etymology. The aerial shoots are, like the basal rootstock, only "slightly woody", which is the reason for the choice of the epithet "suffrutescens", Latin.

Specimens examined

WESTERN AUSTRALIA: *T.E.Aplin et al. 807 & 898*, Kalumburu road, 174.4 km N Gibbs River road, 30.iv.1985/2.v.1985 (PERTH); *R.L.Barrett 3724 & M.D.Barrett*, 11.7 km S King Cascade Falls, Prince Regent Reserve, 22.i.2007 (PERTH); *P.A.Fryxell, L.A.Craven & J.McD.Stewart 4711*, 6 km E Careening Bay, 9.vi.1985 (CANB); *A.S.George 12544*, Blyxa Creek, Prince Regent River Reserve, 22.viii.1974 (PERTH).

30. *Hibbertia axillaris* Toelken, *sp. nov.*

Hibbertiae suffrutescenti *similis sed foliorum paginis adaxialis velutinis, bracteis liniari-triangularibus antherisque 42–50; a* H. caudice *et* H. rufociliata *bracteis linearo-triangularibus non amplectentibus et tomento velutino differt.*

Typus: Western Australia, 15 km W Mitchell Falls, *P.A.Fryxell, L.A.Craven & J.McD.Stewart 4753*, 11.vi.1985 (holo.: CANB; iso.: PERTH).

Shrublets ca 0.3 m tall, multistemmed from woody rootstock, with wiry-woody branches erect to decumbent; branches strongly ridged from the centre of the leaf base, pubescent to usually almost velutinous. Vestiture persistent, with short dense erect-spreading rosette-like ± broad-based fascicled hairs on branches, leaves and bracts, and with ciliolate-peltate to entire scales on calyx; *on branches* moderately dense, with short subequal erect-spreading rosette-like ± broad-based fascicled hairs (6–8 often unequal arms) varying from bristly erect to cactiform ones; *on leaves above* dense, with subequal fine erect-spreading rosette-like moderately broad-based fascicled hairs (6–10 subequal arms, but few hairs with slightly longer ones); *on leaves below* similarly dense as above and covered with similar hairs except usually more spreading; *on bracts* above and below dense, with similar fine subequal hairs also on the margins; *on outer calyx* outside dense, with mainly ciliolate narrow-rimmed scales becoming smaller towards the margins to end with a row of unilaterally enlarged marginal cilia, inside with few scattered fascicled hairs on upper third; *on inner calyx lobes* dense, with narrow-rimmed scales, overtopped by a few larger ciliolate broad-based scales in the centre, becoming smaller towards a short membranous margin topped mainly with thin-based fascicled cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 1.6–3.2 mm long; *lamina* elliptic-oblanceolate, (11.8–) 25–40 (–48.6) × (4.7–) 6–9 (–11.2) mm, obtuse to rounded but with vein-end ca 1 mm long and topped by long bristles of ± reduced unilaterally enlarged fascicled hairs, gradually tapering into petiole, entire, flat, above scarcely grooved along the central vein, with intramarginal and some lateral veins visible, sparsely velutinous to pubescent, below with raised central vein and usually intramarginal veins but rarely lateral ones visible, sparsely velutinous, scarcely discolourous; juvenile leaves not seen. *Flowers* 1, "axillary", with rudimentary short shoots often visible, along the upper branches, with buds spherical or slightly ellipsoidal; *peduncle* ± thread-like, 7.5–10 (–14.8) mm long, terete or almost so; *bracts* linear-triangular, 1.8–2.3 × 0.25–0.4 mm, acute to acuminate, not clasping peduncle, not ridged but ± lengthwise folded and loosely appressed, outside and inside velutinous. *Calyx* with lobes unequal; *outer calyx lobes* (2) elliptic to elliptic-oblanceolate, 3.2–4.1 × 1.9–2.2 mm, half to two-third of inner ones, acute to pointed, scarcely ridged, appressed, outside densely ciliate-scaly to ± prominently unilaterally enlarged spreading fascicled hairs along the margins, inside glabrescent on upper third; *inner calyx lobes* (3) oblong-obovate to obovate, 4.2–4.6 × 4.6–5.4 mm, rounded and without ridge, outside densely scaly and mainly with fascicled cilia on narrow membranous margins, inside glabrous. *Petals* broadly obovate, 8.3–9.6 mm long, deeply bilobed. *Stamens* 42–50 (without staminodes), subequal, around ovaries; *filaments* filiform, 1.1–1.4 mm long, scarcely connate basally; *anthers* obloid, 0.9–1.3 mm long, abruptly contracted above and below, straight. *Pistils* 3; *ovaries* obovoid, each with 3, 4 basal ovules, densely scaly, with style thickened in the middle, attached to dorso-lateral apex, from there curved out-, up- and again inward to place the constricted stigmas well above the anthers. *Fruiting peduncle* elongating, ± recurved. *Seeds* not seen. *Flowering*: June. **Fig. 13A–D**.

Distribution and ecology. Recorded from wet sandy soil near a stream in eucalypt woodland near Mitchell Falls, north-western Western Australia (NK).

Conservation status. Unknown.

Diagnostic features. Hibbertia axillaris is similar to *H. suffrutescens*, but the latter is distinguished by short shoots developing at the base of the stems, the upper leaf surface being mainly covered with cactiform fascicled hairs, oblanceolate leaves, triangular bracts with base clasping peduncles, and less than forty stamens.

This species also resembles closely *H. caudice* and associated species, from which it is distinguished by the linear-triangular bracts, which do not clasp the peduncle, and the velutinous tomentum with erect-spreading rosette-like, often thin-based fascicled hairs as well as the velutinous bracts.

Variation. Although juvenile leaves were not seen, the lowest leaves on some branches agreed with findings in other species of this complex that juvenile leaves are slightly broader and covered with fewer and finer, but spreading fascicled hairs. However, the leaves were not lobed.

In contrast to some forms of *H. caudice* from Queensland both surfaces are about equally densely hairy.

Etymology. The epithet "axillaris", Latin, refers to the "axillary" flowers of the species.

Specimens examined.

Known only from the type collection.

31. *Hibbertia caudice* Toelken, *sp. nov.*

Hibbertiae cistifoliae *similis sed antheris equalibus, alabastris sphaericis bracteisque ovatis vel late lanceolatis; a* H. oblongata *foliis sparsim pubescentibus praecipue in paginis abaxialibus, habitu multicaule et caulibus filo metallico similis differt.*

Typus: Northern Territory, Nhulunbuy, *G.M.Wightman 4279*, 22.ii.1988 (holo.: CANB; iso.: DNA; BRI, MEL – *n.v.*).

Hibbertia cistifolia auctt. non R.Br. ex DC.: C.T.White, Proc. Roy. Soc. Queensland 57: 21 (1946), pro parte quoad *Flecker BRI 10051*; Specht in Specht & Mountf., Rec. Amer.-Austral. Exped. Arnhem Land 3: 260, 383 (1958), pro parte quoad *Specht 843*; Harmer, N. Austral. Pl. 46 (1976), pro parte quoad fig.; Dunlop et al., Checklist Vasc. Pl. Northern Territory 43 (1995), pro parte; Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007).

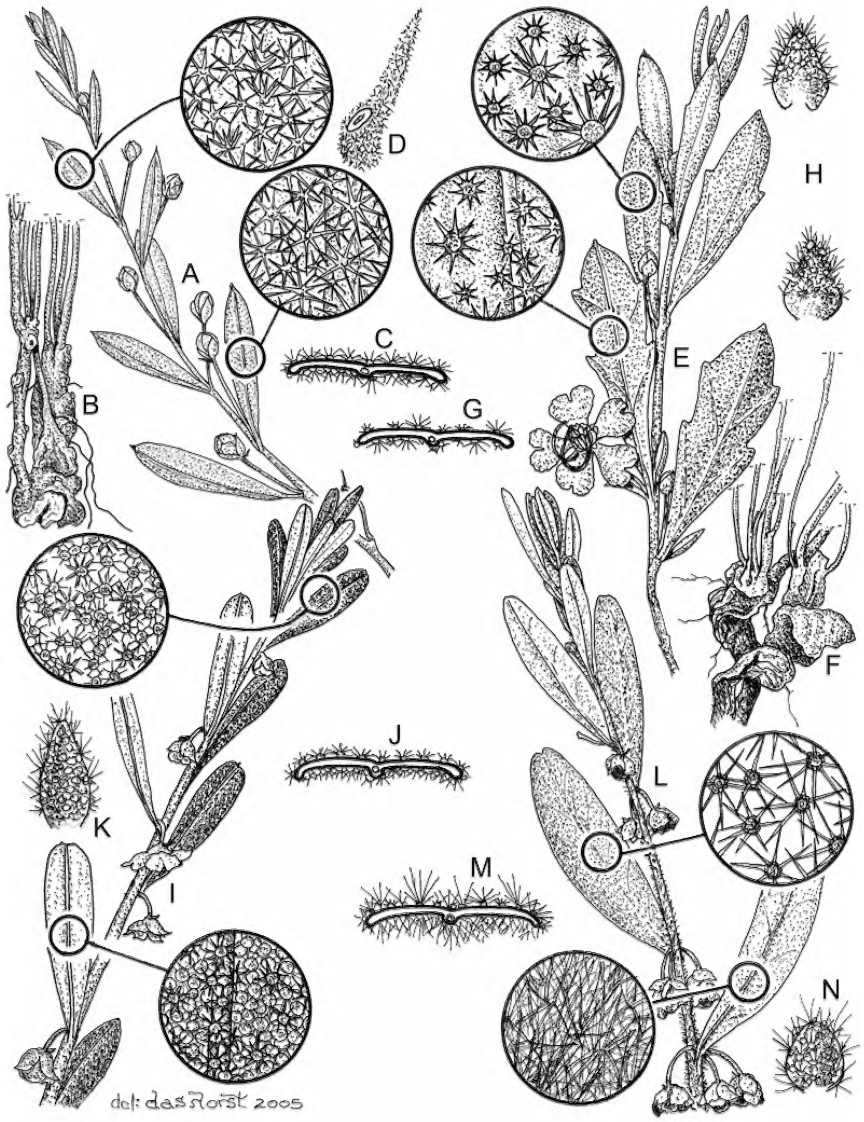


Fig. 13. **A–D** ***H. axillaris***: **A** flowering branch ×1; **B** thick rootstock ×1; **C** transverse section through mid-leaf ×5; **D** linear bract ×10. **E–H** ***H. caudice***: **E** flowering branch ×1; **F** thick rootstock ×1; **G** transverse section through mid-leaf ×2.5; **H** ovate bract ×6. **I–K** ***H. rufociliata***: **I** fruiting branch ×1; **J** transverse section through mid-leaf ×5; **K** ovate bract ×10. **L–N** ***H. cymosa***: **L** flowering branch ×1; **M** transverse section through mid-leaf ×3; **N** ovate bract ×5. — **A–D** *P.A.Fryxell, L.A.Craven & J.McD.Stuart 4753*; **E–H** *L.S.Smith 12460*; **I–K** *L.J.Brass 17597*; **L–N** *A.R.Bean 1713.*

Hibbertia sp. Darwin (*C.R.Dunlop 3120*): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrub up to 1 m but usually ca 0.4 m tall, multistemmed from a woody rootstock, often little-branched stems, erect to decumbent; wiry branches usually strongly angular from the centre of the leaf base, pubescent, puberulous or stubble-like. *Vestiture* persistent, with reflexed rosette-like broad-based fascicled hairs ± reduced to cactiform hairs or ciliate narrow-rimmed peltate scales on stems and leaves, and peltate scales (sometimes ± ciliate) on bracts and calyx; *on branches* ± dense, with larger over a range of smaller rosette-like to cactiform broad-based fascicled hairs (6–11 often unequal spreading arms becoming shorter to very short on some to all the smaller hairs), or (mainly in Queensland) with ± ciliate narrow-rimmed, rarely some broad-rimmed peltate scales; *on leaves above* sparse to moderately dense, with scarcely larger and

smaller rosette-like broad-based fascicled hairs (7–14 subequal or scarcely unequal spreading to reflexed arms), rarely smaller ones with short arms to cactiform, or in Queensland rarely with ± ciliate narrow-rimmed peltate scales, with base of hairs often ± sunk into the leaf surface; *on leaves below* moderately to dense, with few larger over/and somewhat smaller rosette-like to cactiform broad-based fascicled hairs (7–14 subequal to ± unequal usually reflexed arms) or narrow-rimmed to broad-rimmed scales with or without cilia, occasionally with bases sunk into the surface; *on bracts* below ± dense, with scales and with prominent unilaterally enlarged rosette-like fascicled hairs to ciliate-peltate scales towards the margins, above more sparse, with rosette-like to cactiform fascicled broad-based hairs, often becoming very reduced in the axils, below ± dense, with scales and with prominent unilaterally enlarged rosette-like fascicled hairs to ciliate-peltate scales towards the margins; *on outer calyx lobes* outside dense, with few larger over smaller scales and with prominent unilaterally enlarged cilia along the margins, inside sparse, with rosette-like (usually only with antrorse cilia) to cactiform broad-based fascicled hairs on the upper half; *on inner calyx lobes* outside dense, with few larger over smaller scales and mainly fascicled cilia at least towards the apex, inside glabrous or with few cactiform broad-based fascicled hairs near the apex. *Leaves* without axillary tuft of hairs; *petiole* (0.2–) 0.3–1.5 (–3.3) mm long; *lamina* elliptic, elliptic-oblanceolate, 8.2–76.2 × 2.1–25.6 mm, obtuse to rounded and ± cuspidate, rarely acute with vein-end covered with short-branched appressed hairs, gradually tapering into petiole, entire, undulate, toothed to shallowly lobed, flat, above scarcely grooved along the central vein and puberulous to rarely stubble-like or rarely pubescent, below with central vein raised and sinuate intramarginal as well as some lateral veins ± visible, denser (than above) pubescent to stubble-like or ciliate-scaly, discolourous; juveniles leaves (regenerating) toothed or lobed (1–5 lobes on each side), flat, with central, secondary and intramarginal vein visible but often not strongly developed, sparsely covered with rosette-like broad-based fascicled hairs with few appressed arms. *Flowers* 1 or 2 (3), "axillary", with or without rudimentary leaves or rarely on fully developed lateral shoots, with buds ± spherical, often nodding on straight peduncle; *peduncles* often thread-like, (8.2–) 10–18 (–23.6) mm long, ± terete; *bracts* broadly ovate to triangular-lanceolate, (0.9–) 1.2–1.6 (–2.1) × 0.7–1.5 mm, acute to obtuse, ± ridged along the centre, with recurved apex, more densely scaly below, ± ciliate-peltate and especially unilaterally enlarged fascicled hairs along margins. *Calyx* with lobes unequal; *outer calyx lobes* (2) ovate to orbicular, rarely ovate-oblong, (2.1–) 2.8–4.2 (–4.6) × 2.2–3.5 mm, half to two-thirds or rarely as long as inner ones, usualy obtuse and recurved, rarely acute or rounded and cuspidate, with second one frequently longer and almost appressed, usually faintly ridged on upper half, outside densely scaly with unilaterally enlarged scales and cilia along the margins, inside stubble-like to pubescent on upper half; *inner calyx lobes* (3) oblong-obovate to broadly obovate, (4.3–) 4.8–5.5 (–6.3) × (3.4–) 3.8–4.5 (–4.9) mm, rounded with membranous margin, without ridge, outside densely scaly and with unilaterally enlarged cilia to ± fascicled cilia at least towards the apex, inside glabrous or with rudimentary fascicled hairs around the apex. *Petals* usually broadly obovate, (7.2–) 9–12.5 (–13.7) mm long, deeply bilobed. *Stamens* 24–26 (–30) (with few or without staminodes), subequal, in groups around ovaries; *filaments* strap-like, 0.6–1.1 mm long, scarcely basally connate; *anthers* obloid, 0.75–1.4 mm long, abruptly constricted above and below, papillose. *Pistils* 2: *ovaries* obovoid, each with 2 basal ovules, densely scaly, with style attached to the dorso-centrifugal apex, from there curved up- and out- then again inward to place the constricted stigmas well above the anthers. *Fruiting peduncles* elongating, recurving or fruits nodding. *Seeds* broadly obovoid, 2.8–3.1 × 2.6–2.9 mm, black or brown; *aril* with fleshy basal attachment enlarging into a short sheath (scarcely lobed) covering the basal third of the seed. *Flowering*: November–March, but records of flowers throughout the year exist. **Figs. 1A, 2F & 13E–H**.

Distribution and ecology. Grows on sand or sandy clay soils often above creek banks in open eucalypt woodland in the low lands south of Darwin, on Bathurst and Melville islands and north-eastern Arnhem Land, Northern Territorry (A) and northern Queensland (Co).

Conservation status. Widespread and locally common.

Diagnostic features. Hibbertia caudice resembles and has often been confused with *H. cistifolia* because of its similar habit of resprouting annually from a woody rootstock, but it is distinguished from the latter by the short ovate eared and/or clasping bracts, almost spherical buds becoming pyriform when fruiting, subequal anthers and style bases not covered with peltate scales. Specimens without the multistemmed base of *H. caudice* are very similar to those of *H. oblongata*. They are distinguished by the usually having wiry branches, the common occurrence of appressed hairs and at least some cactiform fascicled hairs on leaves and branches. The shrubby *H. rufociliata* also closely resembles *H. caudice*, but is distinguished in addition to its always entire but more or less recurved leaf margins, by having appressed obtuse to rounded bracts and outer calyx lobes, and a calyx with long brown cilia. *H. brevipedunculata*, which has a similar habit, is usually distinguished from *H. caudice* by its usually ellipsoidal flower buds, narrow not-clasping bracts, more than thirty stamens, and normally more or less recurved leaf margins.

Variation. The two forms of this species are readily recognised by the presence or absence of toothed leaves. This character varies largely due to local differences in the retention of some juvenile stages in the annual

regrowth of the aerial shoots for a longer or shorter period. These sprouts are at first covered with scale-like leaves, then their leaves are expanded and become obovate but remain entire, and from about the seventh leaf upward they have 1–5 teeth on each side of the upper half of the leaf, but these are ultimately superseded by entire adult leaves which tend to be narrower than those of the previous stage. The early stages have also a very sparse vestiture, which becomes gradually denser, particularly on the undersurface of leaves as new leaves develop.

The first flowers usually appear before adult leaves develop. In the form prevalent in the area from north-west of Arnhem Land and particularly Melville and Bathurst islands but also in areas south of Darwin this penultimate juvenile stage is usually prolonged, as only occasionally entire adult leaves have been recorded. Furthermore the vestiture usually remains less dense on the undersurface of leaves than on the upper surface of many specimens examined.

Leaves of plants from north-eastern Arnhem Land and northern Queensland have normally entire to faintly sinuate leaf margins with vein-ends usually situated on small rounded irregular protrusions. Plants from Queensland also tend to be larger and often do not show vigorous annual regrowth and the multistemmed base of these plants is often not visible on herbarium specimens.

The habit of plants from the Northern Territory always appears to be truly multistemmed with one basal root stock continuing into the tap root (*G.M.Wightman 4279*), while specimens from Queensland have a similar habit (*L.J.Brass 18844*), except that the base is usually more branched below the soil surface and each stem develops a separate basal tuber.

Fully developed scales, with or without cilia, were only observed in plants from Queensland. In all cases some variation, and in many specimens a whole range from rosette-like to cactiform hairs and peltate scales, was found on leaves of the same plant from the base upward. The fascicled hairs are retained in different plants for a longer or shorter period, and, for instance, flowering specimens with rosette-like to cactiform fascicled hairs (*J.R.Clarkson 2890*) and with narrow-rimmed to broad-rimmed peltate scales (*L.J.Brass 18499*) were both recorded from Tozers Gap.

Etymology. This species has often been confused with *H. cistifolia* because it has a similar woody rootstock from which it generally resprouts annually and the epithet "caudice", Latin, "with rootstock" (noun in apposition, ablative singular) refers to this character.

Selection of specimens examined (51 seen)

NORTHERN TERRITORY: *K.G.Brennan 2429*, 15 km WSW Cape Arnhem, 14.ii.1994 (DNA); *I.D.Cowie 1358*, near Marlow Lagoon, 18.i.1991 (AD, CANB); *J.E.Denison-Woods & M.Holtze 526*, North Australia, 1886 (MEL); *C.R.Dunlop 3120*, 7 miles NE Finnis River Crossing, 16.i.1973 (CANB, NT); *P.I.Forster 6102*, Secret Jungle, Melville Island, 26.xi.1989 (BRI, CANB); *G.J.Leach 2917 & I.D.Cowie*, Melville Island, 1m N 9 mile waterhole, 20.i.1992 (AD); *G.J.Leach 3933 & C.R.Dunlop*, Bathurst Island, 10 km from Nguirr on Port Hurd road, 12.i.1994 (DNA); *J.Russell-Smith 1016*, 3 km S Munmulary HS, 25.i.1984 (DNA); *J.Russell-Smith 3361 & Lucas*, Giddy River, 16.ix.1987 (DNA); *R.L.Specht 843*, Yirrkala, 8.viii.1948 (AD); *N.Scullion DNA 128608*, Inglis Island, 30.iv.1996 (DNA).

QUEENSLAND: *L.J.Brass 18407*, Cody Creek, 13 miles WSW Somerset, 25.iv.1948 (CANB); *L.J.Brass 18499*, Tozers Gap, 9.vii.1948 (CANB, BRI); *L.J.Brass 18499*, Tozer Gap, 9.vii.1948 (CANB); *L.J.Brass 18844*, Jardine River, 19.v.1948 (BRI, CANB); *S.J.Dansie 20120*, Bamaga, 10.v.1975 (QRS); *J.R.Clarkson 8930 & V.J.Neldner*, 3 km N South Five Mile Creek, 17.iv.1991 (QRS); *B.J.Conn 3794 & A.N.L.Doust*, 7.3 km W Tozers Gap, 5.vi.1993 (AD); *D.G.Fell 400*, ca 25 km NNE Coen, 12.vi.1986 (CANB); *H.Flecker BRI 10051*, 10 miles N Iron Range, 14.iv.1944 (BRI, QRS); *P.I. Forster 6350*, 6 km along Somerset road, (AD, BRI, DNA); *C.H.Gittens 1029*, Tozer Gap, viii.1965 (BRI, MEL); *R.W.Johnson 4971*, 18.4 km SE Heathlands, 28.ii.1992 (DNA); *D.L.Jones 8849 & C.H.Broers*, N Cockatoo Creek, 21.i.1992 (QRS); *V.J.Neldner 3526 & J.R.Clarkson*, I.8 km E Brown Creek to Portland Roads, 4.vii.1991 (QRS); *R.L.Specht W371*, 30 km ESE Weipa Mission, 24.vii.1974 (BRI); *K.A.Williams 85139*, Bamboo range, 21 km N Musgrave Range, 18.viii.1985 (BRI).

32. *Hibbertia rufociliata* Toelken, *sp. nov.*

Hibbertiae cymosae *similis sed ramis pilorum brevissimis et plerumque floribus singularibus axillaribus; a* H. oblongata *caulibus et pedunculatis ecarinatis ciliisque prominentibus rufis in bracteis et calicibus differt.*

Typus: Queensland, Cook district, Browns Creek, Pascoe River, *L.J.Brass 19597*, 15.vii.1948 (holo.: BRI; iso.: CANB).

Hibbertia oblongata auct. non R.Br. ex DC.: Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007).

Shrubs up to 1.5 m tall, but usually only 0.5–0.8 m; wiry-woody branches with rounded flanges continuing from the leaf bases, tomentose to stubble-like. *Vestiture* persistent, with spreading to reflexed rosette-like broad-based fascicled hairs usually with very short arms on branches and leaves, and ciliate-scaly to scaly on peduncle, bracts and calyx; *on branches* dense, with scattered larger erect rosette-like broad-based fascicled hairs (6–9 ± subequal arms) over dense cactiform rosette-like broad-based fascicled hairs; *on leaves above* moderately dense, with scattered slightly larger spreading to reflexed rosette-like broad-based fascicled hairs (8–15 subequal arms) with many cactiform rosette-like broad-based fascicled hairs often ± sunk into the upper surface; *on leaves below* very dense, with subequal rosette-like broad-based fascicled hairs each with very short reflexed arms overtopped only here and there by slightly larger rosette-like broader-based fascicled hairs usually associated with lateral veins; *on bracts* below dense, with ciliate narrow-rimmed peltate scales and rufous unilaterally enlarged rosette-like

broad-based fascicled hairs along the margins, above with scattered antrorse often thin-based fascicled hairs; *on outer and inner calyx lobes* outside dense, with small often narrow-rimmed peltate scales becoming smaller towards the membranous margins terminating into thin-based unilaterally enlarged cilia, inside glabrous or with few antrorse hairs at the apex. *Leaves* without axillary tuft of hairs; *petiole* 0.6–2.4 mm long; *lamina* elliptic-oblanceolate to linear-oblanceolate, (10.3–) 25–35 (–61.5) × (2.3–) 3–7.5 (–12.6) mm, rounded to obtuse, rarely cuspidate or truncate with vein-end covered with short appressed hairs, gradually constricted into petiole, entire, flat or with ± recurved margins, above grooved along the central vein (no other veins visible) and stubble-like to almost smooth with hair bases ± sunk, below central vein raised and often 6–10 laterals as well as sinuate intramarginals ± visible, shortly tomentose, distinctly discolourous; juvenile leaves not seen. *Flowers* 1 (2 or 3), "axillary" with or without rudimentary leaves (often very similar to bracts but without cilia) or rarely with short shoot and then often with more than one flower, along upper branches, with buds spherical; *peduncle* stout, 3.5–4.8 (–11.2) mm long, terete; *bracts* broadly ovate, 1.2–1.7 × 1.1–1.4 mm, ca one-third of outer calyx lobes, obtuse rarely acute, erect, appressed and base clasping peduncle, scaly and with prominent unilaterally enlarged cilia. *Calyx* with lobes unequal; *outer calyx lobes* (2) broadly oblong-ovate to -obovate, 3.4–4.1 × 1.2–1.4 mm, about half to two-thirds of inner ones, obtuse to rounded, without central ridge, outside densely scaly and with unilaterally enlarged to fascicled cilia on ± membranous margin, inside ± glabrous; *inner calyx lobes* (3) broadly oblong-obovate to obovate, 4.6–5.2 × 3.8–4.8 mm, rounded, without ridge, outside densely scaly and on membranous margin with fascicled cilia, inside glabrous. *Petals* obovate to cuneate-, 6.6–7.8 mm long, bilobed. *Stamens* 36–44 (without staminodes), subequal, arranged around ovaries; *filaments* filiform, 1.8–2.3 mm long, scarcely connate basally; *anthers* obloid, 0.8–1.1 mm long, abruptly constricted above and below, ± straight. *Pistils* 2: *ovaries* broadly obovoid, each with 2 basal ovules, densely scaly, with styles attached to the dorso-lateral apex and then turned out and gradually upwards with contricted stigmas usually upwards at the same level as but well outside the stamens. *Fruiting peduncle* scarcely elongating, strongly recurved. *Seeds* obovoid, 2.4× 2.1 mm, dark brown; *aril* with fleshy attachment extending into a cup-like membrane (scarcely lobed) covering the lower third of seed. *Flowering*: April–July. **Fig. 13H–J**.

Distribution and ecology. Grows on sandy ridges with *Agonis* scrub to bloodwood/ stringybark forests near Browns Creek, northern Queensland (Co).

Conservation status. L.J.Brass 19597 records the frequency of this species as occasional, and it can also be deduced from there being only one collection during their expedition that this species is not common.

Diagnostic features. Although this species is superficially very similar to *H. oblongata* from the Northern Territory *H. rufociliata* is distinguished by the absence of strongly keeled to winged branches and peduncles, the prominent cilia on bracts and calyx, and greater number of stamens. The very short, often reflexed arms of most of the fascicled hairs, the usually short peduncle, and usually single axillary flowers with less than 45 stamens distinguish *H. rufociliata* from *H. cymosa*.

Variation. There are a few leaf axils on the collection *P.I.Forster 4158 & D.J.Liddle* which have developed short shoots each with 2 or 3 flowers rather like in *H. cymosa,* a species somewhat similar to *H. rufociliata.*

Etymology. The "rufous cilia" are such a prominent characteristic of this species that they are referred to in the epithet "rufo-ciliata", Latin.

Specimens examined

QUEENSLAND: *P.I.Forster 4158 & D.J.Liddle*, Iron Range Road, ca 1 km upstream Browns Creek, 14.iv.1988 (BRI).

33. *Hibbertia cymosa* S.T.Reynolds

Austrobaileya 3(3): 537, fig. M-R (1991); in R.J.F.Hend., Queensland Pl. 65 (1997); Jessup in Bostock & A.E. Holland, Cens. Queensland Fl. 64 (2007). — **Typus**: Queensland, Cook district, Sandy Creek area, NE of Jowalbinna, *A.R.Bean 1713*, 4.vii.1990 (holo.: BRI; iso.: K – *n.v.*).

Shrubs up to 1.4 mm tall, little branched; branches rigid woody, ± ridged but ridges usually hardly visible under hairs, hirsute. *Vestiture* persistent, with long spreading rosette-like broad-based fascicled hairs on branches and leaves, with cactiform to usually small scales on bracts and densely scaly on calyx; *on branches* moderately dense, with many larger erect-spreading rosette-like broad-based fascicled hairs over a range of similar smaller ones (6–10 usually unequal arms); *on leaves above* moderately dense, with spreading rosette-like broad-based fascicled hairs (6–10 subequal arms) rarely slightly larger ones on the flanks (9–14 subequal arms) over few scattered cactiform fascicled hairs mainly towards the margins; *on leaves below* very dense, with larger spreading rosette-like broad-based fascicled hairs (8–10 usually unequally long arms) on the central vein and sometimes on the recurved margins particularly towards the base and with very dense finer spreading rosette-like thin-based fascicled hairs (induvidual hairs are rarely visible but usually 6–8 often unequally long arms); *on bracts* below with moderately dense ciliolate narrow-rimmed peltate scales becoming cactiform fascicled hairs towards the margins and prominent unilaterally enlarged rosette-like fascicled hairs on the margins, inside with fewer antrorse rosette-like hairs; *on outer and inner calyx lobes* outside dense, with larger usually broad-rimmed over smaller narrow-rimmed scales and the latter particularly towards the margins, but ± glabrous membranous margins topped with long

fascicled cilia, inside glabrous or sparsely hairy towards the apex. *Leaves* without axillary tuft of hairs; *petiole* 1.6–2.8 mm long; *lamina* oblanceolate-elliptic to oblong-elliptic, (20.2–) 40–53.4 × (8–) 12–15 (–18) mm, obtuse to rounded, ± mucronate with prominent tuft of fascicled hairs some of which are reduced to a single branch on the distal vein-end, gradually tapering into petiole, entire, flat or with ± recurved margins, above grooved along the central vein and pubescent, below central vein raised but laterals hardly visible and hirsute particularly towards the base, distinctly discolourous; juvenile leaves not seen. *Flowers* 1–3, "axillary", with or without rudimentary leaves, along branches, with buds ± spherical; *peduncle* slender, 6.6–9.5 mm long, slightly laterally compressed; *bracts* ovate, 1.4–2.1 × 1.3–1.5 mm, ca one-third of outer calyx lobes, obtuse to minutely cuspidate, without central ridge, somewhat clasping peduncle, outside scaly to stubble-like with prominent marginal cilia, inside sparsely pubescent. *Calyx* with lobes unequal; *outer calyx lobes* (2) broadly elliptic-obovate, 2.6–3.8 × 2.9–3.5 mm, ca two-third of inner ones, rounded, without central ridge, outside densely scaly to stubble-like towards the margins with prominent unilaterally enlarged marginal hairs and/or cilia, inside glabrous; *inner calyx lobes* (3) broadly obovate, 4.7–5.6 (–5.9) × 4.6–5.3 mm, rounded rarely emarginate, without central ridge, outside densely scaly and on membranous margin usually with fascicled cilia, inside puberulous to glabrous. *Petals* obovate, 7–8 mm long, bilobed. *Stamens* 50–80 (without staminodes), subequal, arranged around ovaries; *filaments* filiform, 1.2–1.5 mm long, scarcely connate basally; *anthers* obloid, 0.6–0.8 mm long, abruptly constricted above and below, straight. *Pistils* 2 (3); *ovaries* broadly obovoid, each with 2 basal ovules, densely scaly also on style base, with styles attached to the dorso-lateral apex and then turned out-, up- and again inwards to place the constricted stigmas well above the anthers. *Fruiting peduncle* slightly elongating, recurved. *Seeds* obovoid to almost spherical, 2–2.5 (–2.7) × 2–2.5 mm, brownish-black; *aril* with fleshy attachment extending into a cup-like membrane (irregularly lobed and striate) covering the lower two-third of seed. *Flowering*: June. **Fig. 13L–N**.

Distribution and ecology. "Growing beside creek, with *Lophostemon suaveolens* and *Dillenia alata*" near Jowalbinna, northern Queensland (Co).

Conservation status. Unknown.

Diagnostic features. This species is similar to *H. rufociliata* and *H. caudice* but easily distinguished by its shaggy tomentum especially on the branches and lower surface of the leaves as well as the more numerous stamens. The hairs on the upper leaf surface of *H. cymosa* are also more erect-spreading, while those of the other two species tend to be reflexed and often sunk into the upper surface.

The long silky hair on the branches and undersurface of the leaves is reminiscent to species, such as *H. malacophylla* in the *H. melhanioides* subgroup, but flower buds are almost spherical with more or less rounded outer calyx lobes and, most importantly, the scales on the ovary are around, but do nor ascend the style base. The last characteristic distinguishes immediately some forms of *H. echiifolia*, *H. araneolifera* and *H. eciliata* as belonging to the *H. melhanioides* subgroup although their flower buds are also almost spherical.

Specimens examined.

Known only from the type collection.

34. *Hibbertia complanata* Toelken, *sp. nov.*

A H. echiifolia *floribus axillaribus secus rames absentiaque caepidum axillarum pilorum ruforum; a* H. fractiflexa *floribus majoribus pistillisque tribus differt.*

Typus: Western Australia, Augustus Island, *P.A.Fryxell, L.A.Craven & J.McD.Stewart 4698*, 8.vi.1985 (holo.: CANB 377016; iso.: CANB 377017, PERTH).

Hibbertia echiifolia auct. non R.Br. ex Benth.: J.R.Wheeler, Fl. Kimberley Region 152 (1992), pro parte.

Shrub to 0.2 m tall, spreading to mainly prostrate; branches up to 0.4 m long, laterally compressed to flattened and ± ridged, moderately to densely scaly. *Vestiture* persistent, with few larger over a range of smaller ciliate-peltate to entire scales (being a mixture of broad- and narrow-rimmed ones) on the whole plant; *on branches* ± dense, with few larger over a range of smaller usually entire peltate scales; *on leaves above* sparse to moderately dense, rarely dense, with few larger with a range of smaller ciliate- to ciliolate-peltate scales and cactiform fascicled hairs, not overtopping the margins; *on leaves below* very dense, with scattered larger ciliolate-peltate scales over a range of smaller usually entire scales sometimes overtopping the margins; *on bracts* above moderately dense to dense, with mainly smaller entire scales, below dense, with few larger over a range of smaller scales and unilaterally enlarged ciliolate scales overtopping the margins; *on outer calyx* outside very dense, with few larger (sometimes ciliolate-peltate) over a range of smaller peltate scales overtopping the margins in the form of unilaterally enlarged ciliate scales, inside moderately dense to dense mainly small ciliolate-peltate scales at least on the upper half; *on inner calyx lobes* outside very dense, with larger over smaller scales, without cilia on narrow membranous margins, inside glabrous. *Leaves* without axillary tufts of hairs; *petiole* 0–2.2 mm long, ± distinct; *lamina* narrowly elliptic, (12.8–) 30–55 (–70.5) × (3.2–) 5–8 (–9.2) mm, acuminate to cuspidate with terminal ciliate scales scarcely overtopping the vein-end, gradually tapering into petiole, flat, entire, above faintly grooved along the central vein and ± densely ciliate-scaly (11–28 scales across in the middle), below with raised central vein and ± incomplete intramarginals, very densely scaly, faintly discolourous; juvenile leaves not seen. *Flowers* 1, rarely 3, "axillary", often on visible

short shoots, along branches, with spherical to pyriform buds; *peduncle* stiffly thread-like, 5–13 (–19) mm long, ± flattened; *bracts* oblong, oblong-lanceolate, (2.2–) 3.2–4.9 × 1.6–2.5 mm, acute and usually appressed, with central ridge, very densely scaly above and below and overtopping margins. *Calyx* with lobes unequal; *outer calyx lobes* (2) oblong, oblong-elliptic or -oblanceolate, (6.1–) 6.5–7.5 (–8.2) × 2.3–3.6 mm, usually shorter than inner ones, acute, ridged in upper half, outside densely scaly and overtopping margins in the form of unilaterally enlarged ciliate scales, inside finely scaly on upper half; *inner calyx lobes* (3) obovate to broadly obovate, (7.3–) 8–9 (–9.3) × 3.5–5.4 mm, rounded, without ridge, outside densely scaly except for membranous margin without cilia, inside glabrous. *Petals* obovate, 6.8–9.2 mm long, deeply bilobed. *Stamens* 20–26 (–40) (with few staminodes), with range of longer and shorter ones, in bundles around the ovaries; *filaments* filiform, 1.7–2.1 mm long, scarcely connate basally; *anthers* slender-obloid, 1.1–1.6 mm long, abruptly constricted above and below. *Pistils* 3; *ovaries* obovoid, each with 2 basal ovules, scaly, with few scales on the style base, with styles attached to the apex and curved out- and upwards and then again inwards to place the narrow stigmas above the anthers. *Fruiting peduncle* scarcely elongating, recurved. *Seeds* obovoid, 2.5–2.65 × 2.2–2.3 mm, blackish-brown; *aril* with fleshy attachment enlarged into a cup-shaped membrane (scarcely lobed) covering the lower quarter of the seed.

Diagnostic features. Older collections had previously been identified as *H. echiifolia*, but *H. complanata* is distinguished from that very similar species by its mainly prostate habit, absence of tufts of rufous hairs in the leaf axils, rufous marginal cilia on the calyx, and, in particular, by the "axillary" flowers along branches (as compared to usually terminal clusters of *H. echiifolia*). All these characteristics are shared with *H. fractiflexa*, and, more importantly, it has a range of sizes of anthers similar to that species while *H. echiifolia* is distinctly heterantherous. *Hibbertia complanata* is, however, different from *H. fractiflexa*, because of the large flowers and three pistils, which are in turn also found in *H. echiifolia*. However, *H. complanata* is also distinguished from both these species by the very dense (up to three layers) cover of fine ciliolate scales on the undersuface of the leaves. This is reminiscent to the *H. argyrochiton* a species of the *H. lepidota* subgroup, but *H. complanata* again differs by the absence of mainly large scales on the undersurface of the petiole and on the vein-end as well as not incurved leaves. However, large scales of especially *H. complanata* subsp. *ampliata* sometimes slightly overtop the margin of the petiole, and unilaterally enlarged scales on the margins of the calyx lobes are occasionally found.

Despite the range of variation observed on the few collections of *H. complanata* examined, the size of the scales and the number of them across the mid-upper leaf surface indicate that the off-shore representatives are genetically distinct and this difference can not be attributed to plants grown under different conditions.

Etymology. The epithet "complanata", Latin, "flattened out" is with reference to flat internodes of young branches and peduncles observed on plants.

Key to subspecies

1. Mid-upper leaf surface with 22–26 (–32) scales across, with larger scales 0.3–0.35 mm in diameter . . . . . 34a. subsp. ***complanata***

1: Mid-upper leaf surface with 11–15 (–18) scales across; with larger scales 0.5–0.7 (–0.9) mm in diameter . . . . . 34b. subsp. ***ampliata***

34a. *Hibbertia complanata* subsp. *complanata*

Leaves: upper surface with 22–26 (–30) scales across the middle, with large scales 0.3–0.35 mm in diameter. *Flowering*: May, June. **Fig. 14H, I**.

Distribution and ecology. Recorded from white sandy soil in valley with acacia woodland and spinifex on Augustus Island, Western Australia (NK).

Conservation status. Described as rare.

Variation. The range of variation of the length and width of leaves of the two subspecies overlap, but the more slender ones of the typical subspecies resemble more closely those of *H. fractiflexa*. A second specimen from Augustus Island (*P.G.Wilson 10639*) is superficially similar to the type, but has up to 30 ciliolate scales across the mid-upper leaf surfaces. The size of these scales, however, falls within a similar range, as is also true for a specimen from Slate Island, *A.A.Mitchell 2287*, but this has up to 35 stamens and one to three flowers per leaf axil on obvious short shoots.

The specimen, *A.Cunningham 312*, which was collected more than 150 years earlier, was easily identified by using the size and number of scales on the leaves as well as the longer petiole.

Specimens examined

WESTERN AUSTRALIA: *A.Cunningham 312*, Careening Bay, 1820 (BM 834620); *A.A.Mitchell 2287*, Slate Island, 5.iv.1992 (PERTH); *P.G.Wilson 10639*, Augustus Island, 12.v.1972 (PERTH); *P.G.Wilson 10987*, Bat Island, 26.iv.1973 (PERTH) (without flowers).

34b. *Hibbertia complanata* subsp. *ampliata* Toelken, *subsp. nov.*

A subspecie typica numero et diametro squamarum in paginis adaxialibus foliorum differt.

Typus: Western Australia, Lushington Brook, Prince Regent River, *C.A.Gardner 9572*, 3.vii.1950 (holo.: PERTH 3029905, right hand specimen with flower; iso.: PERTH 3029905 left hand branches and dupl. sheet).

Leaves: upper leaf surface with 11–15 (–18) scales across, with large scales 0.5–0.7 (–0.9) mm in diameter. *Flowering*: January, July.

Distribution and ecology. Grows on sand or sandstone slopes in *Eucalyptus miniata* or *E. rupestris* woodland

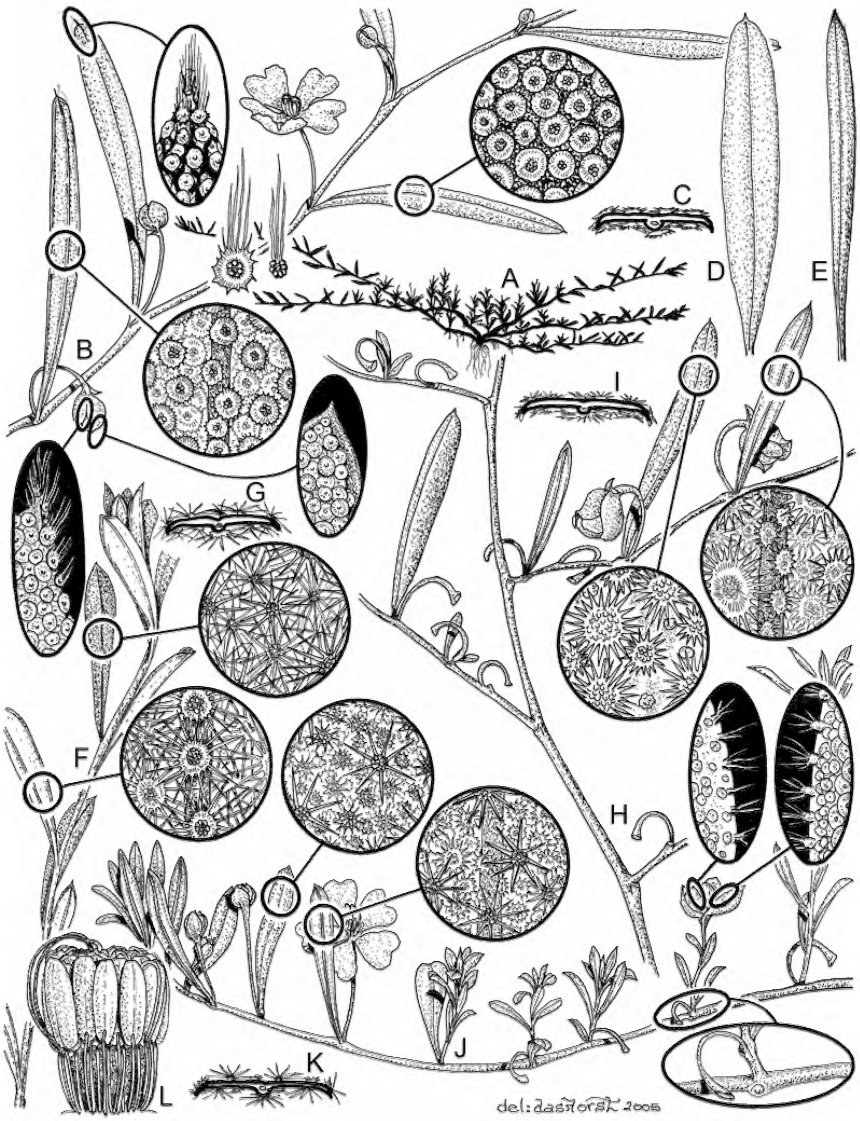


Fig. 14. A–E *H. fractiflexa* — **A–C** subsp. ***brachyblastis***: **A** habit decumbent with numerous short shoots at the base of branches ×0.2; **B** flowering branch with ciliate unilaterally expanded narrow-rimmed scales on the leaf tips ×1; **C** transverse section through mid-leaf ×5. **D** subsp. ***fractiflexa***: leaf ×1. **E** subsp. ***filicaulis***: leaf ×1. **F–G *H. orientalis***: **F** branch ×1; **G** transverse section through mid-leaf ×4. **H–I *H. complanata*** subsp. ***complanata***: **H** fruiting branch ×1; **I** transverse section through mid-leaf ×5. **J–L *H. suffrutescens***: **J** flowering branch ×1; **K** transverse section through mid-leaf ×8; **L** flower with calyx and corolla removed ×10. — **A–C** *L.A.Craven 6348*; **D** *J.D.Briggs 934*; **E** *T.M.Henshall 1980*; **F**, **G** *D.V.McKey 146*; **J–L** *T.G.H. Aplin 898*.

associated with *Triodia* spp., *Acacia kimberleyensis*, *Grevillea wickhamii*, *Cryptandra intratropica*, *Petalostigma quadriloculare* on the lower Prince Regent River, Western Australia (NK).

Conservation status. Locally frequent.

Variation. Despite the variation in leaf shape and size or the length of the petiole seen, the size of large scales as well as the number of scales across the mid-upper leaf surface are consistently different from those of subsp. *complanata*.

Etymology. Because the scales of the mainland plants are considerably enlarged in comparison to those of the typical subspecies as well as *H. fractiflexa*, the epithet "ampliata", Latin, "enlarged" is chosen,

Specimens examined

WESTERN AUSTRALIA: *M.D.Barrett 1184*, 9 km NNW Mt Agnes, 9.i.2001 (PERTH); *M.D.Barrett 1198B*

& R.L.Barrett, 6.2 km ENE of junction of Pitta Creek and Prince Regent River, 29.i.2000 (PERTH); *M.D.Barrett 902 & K.W.Dixon*, 6 km ENE of junction of Prince Regent River and Pitta Creek, 29.i.2000 (PERTH); *M.D.Barrett 970 & K.W.Dixon*, 6.2 km ENE of junction of Prince Regent River and Pitta Creek, 29.i.2000 (PERTH); *R.L.Barrett 4017 & M.D.Barrett*, 6.5 km NE of junction of Pitta Creek and Prince Regent River, 28.i.2007 (PERTH).

35. *Hibbertia fractiflexa* Toelken, *sp. nov.*

A H. echiifolia *fruticis decumbentibus, floribus axillaribus secus rames, antheris usque ad 1.5 mm longis pistilisque duobus; a* H. complanata *floribus minoribus pistilisque duobus differt.*

Typus: Northern Territory, Waterfall Creek, above escarpment, *G.Wightman 1290 & C.R.Dunlop*, 19.iv.1984 (holo.: CANB; iso.: BRI, DNA, MEL).

Shrublets up to 0.8 m tall, multistemmed with wiry scrambling long shoots, each sometimes with short shoots basally; branches flexuous, ridged downwards from the centre of the leaf base, usually sparsely scaly. *Vestiture* persistent, with usually widely spaced larger (rarely broad-rimmed) and smaller scales (rarely ciliolate) on branches, leaves and bracts, to ciliate-peltate on the margins of calyx lobes; *on branches* sparse to dense at nodes, with usually narrow-rimmed or rarely a few broad-rimmed scales (often of irregular shape); *on leaves above* sparse to moderate dense, with larger and smaller usually narrow-rimmed and regular peltate scales; *on leaves below* dense to very dense, with few larger and smaller usually narrow-rimmed ± regular peltate scales and with one to few bristle-like hairs/scales (= arms/cilia) of unilaterally enlarged cilia on terminally protruding central vein-end; *on bracts* moderate above, and very dense below, with narrow-rimmed entire and/or ciliate scales (rarely unilaterally enlarged cilia); *outer calyx lobes* outside very dense, with narrow- and broad-rimmed scales and with some marginal sparsely unilaterally enlarged ciliate scales and sometimes with 1, 2 terminal hairs but wearing off soon, inside glabrous; *on inner calyx* outside very dense, often with many larger broad-based peltate scales scarcely decreasing towards the membranous margin without cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* (0–) 0.3–2.0 (–3.4) mm long, often indistinct; *lamina* elliptic, linear-elliptic, rarely linear, (5.3–) 10–40 (–76.6) × (1.1–) 2–10 (–13.2) mm, cuspidate, rarely acute or shortly acuminate with unilaterally enlarged hairs often reduced to one to few terminal arms on each hair, often becoming obtuse to rounded, gradually tapering into petiole, entire, flat to often folded lengthwise, above with a groove along the central vein and usually sparsely scaly, below with raised central vein and often with straight intramarginal ones visible close to slightly recurved margins but lateral veins are rarely seen, often more densely scaly than above and scales rarely overtopping margins, discolourous; juvenile leaves (seen only for subsp. *filicaulis*: *J.L.Egan 4796 & S.Knox*) rhombic-obovate with a lobe two-thirds up on each side for the first 2 or 3 leaves then oblanceolate becoming linear-elliptic to linear, together with a progression of at first very few rosette-like broad-based fascicled hairs (with unequal arms) to cactiform ones and narrow-rimmed scales on 6th or 7th leaf. *Flowers* 1–3 (–5), "axillary", on short shoots with or without rudimentary leaves developed, buds ± spherical; *peduncle* usually filiform, 8.6–23.7 mm long, ± angular; *bracts* triangular-lanceolate, rarely ovate to lanceolate, 0.8–1.6 × 0.8–1.1 mm, pointed and usually with 1 to few terminal bristles, with apex ± recurved, ± densely scaly above and below, rarely with a few slightly unilaterally enlarged ciliate-peltate scales on the margins. *Calyx* with lobes unequal; *outer calyx lobes* (2) ovate, (2.1–) 2.5–3.5 (–4.6) × 1.8–2.1 (–3.4) mm, about two-thirds of inner ones, acute to pointed, with/without terminal hairs, with apex scarcely recurved, outside densely scaly and with some slightly unilaterally enlarged scales, inside glabrous; *inner calyx lobes* orbicular, rarely broadly obovate, (2.4–) 2.6–3.5 (–4.7) × 3.0–3.7 (–4.4) mm, rounded with membranous margins without cilia, densely scaly outside, glabrous inside. *Petals* cuneate-obovate, 4.7–9.3 mm long, usually deeply bilobed. *Stamens* 16–22 (–26) (rarely few staminodes), subequal, in bundles around the ovaries; *filaments* stubby, 0.4–0.6 mm long, scarcely connate basally; *anthers* obloid, 1.0–1.2 (–1.8) mm, abruptly constricted above and below. *Pistils* 2; *ovaries* broadly obovoid, densely scaly, each with 2 basal ovules, with slender style attached dorsally just below the apex of the ovary then curved out- and upwards and terminating in constricted stigma hooked inward above the anthers. *Fruiting peduncle* elongating and recurved. *Seeds* almost spherical, 2.2–2.35 mm in diameter, brown to black; *aril* with fleshy basal attachment expanding into a cup-shaped sheath (scarcely lobed) covering the lower two-third to three-quarter of the seed.

Diagnostic features. Hibbertia fractiflexa resembles *H. echiifolia* in having similar small scales which are usually narrow-rimmed unlike those of the *H. lepidota* subgroup. The scales scarcely overtop the leaf margins and especially not the margins of the petioles. The new species is distinguished from *H. echiifolia* by the decumbent to scrambling habit, its axillary flowers each with two pistils, and subequal anthers up to 1.5 mm long. *Hibbertia complanata* from Western Australia is also very similar but differs by larger flowers and three pistils.

Variation. The characteristic zigzagging long shoots are found in all subspecies of *H. fractiflexa*, but are not always equally strongly developed on different plants or even on all branches of the same plant.

A wide range of variation was also observed in the length of the petiole, not only because it is difficult to delimit it from the often very gently tapering leaf lamina. In addition the petioles on long shoots tend to be several times longer than those of leaves born on short shoots, where they are occasionally absent. Similarly the lamina of leaves of the long shoots is up to three times longer than those of short shoots.

The left specimen *A.Cunningham 313b* (K) from South Goulburn Island, although close to *H. fractiflexa* could not be placed in one of the four subspecies recognised here, because it was without flowers.

Etymology. The epithet "fractiflexa", Latin, "zigzag", refers to this characteristic feature of the long shoots.

Key to subspecies

1. Leaves 1.1–2.2 mm broad; scales on upper leaf surface up to 0.15 mm in diameter . . . . . 35d. subsp. ***filicaulis***
1: Leaves (2.3–) 3.5–6 (–13.2) mm broad; scales on upper leaf surface 0.15–0.6 (–0.7) mm in diameter
2. Mid-upper leaf surface with 12–16 (–22) scales across. . . . . 35a. subsp. ***fractiflexa***
2: Mid-upper leaf surface with (20–) 28–34 (–36) scales across
3. Branches without basal short shoots; stamens 24–26. . . . . 35b. subsp. ***serotina***
3: Branches with many basal short shoots; stamens 16–20 (–22) . . . . . 35c. subsp. ***brachyblastis***

35a. *Hibbertia fractiflexa* subsp. *fractiflexa*

Hibbertia sp. 7 K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996).
Hibbertia sp. prostrate (*K.H.L.Key 30/Mar/73*): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Scrambler mainly with long shoots, but occasionally also with few short shoots from basal nodes. *Leaves* (5.1–) 6–10 (–12.4) mm broad, obtuse to rounded with recurved vein-end with few short hairs; with 12–16 (–22) scales across mid-upper surface and with large scales (0.48–) 0.5–0.6 (–0.7) mm in diameter. *Flowers* 1 (2) per axillary short shoots usually without or rarely with reduced blunt leaves; outer calyx lobes (3.0–) 3.1–3.3 (–3.4) mm long; inner calyx lobes 3.2–3.4 mm long; 16–20 (–22) stamens and anthers 1.1–1.35 mm long. *Flowering*: November–June. **Fig. 14 D**.

Distribution and ecology. Grows on rocky slopes or often in shallow sandy soil in crevices in sandstone outcrops in scrub vegetation under open woodland, often on riverbanks or on lower slopes of the western escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Locally frequent in Kakadu National Park.

Variation. In contrast to the subsp. brachyblastis the typical subspecies shows little variation in spite of its disjunct distribution. While the leaf apex of this subspecies is usually blunt or even rounded, it was acute to pointed on plants of the specimen *P.Martensz & R.Schodde AE711*.

Broad-rimmed scales are mainly restricted to this the most robust of all the subspecies.

Selection of specimens examined (33 seen)

NORTHERN TERRITORY: *K.G.Brennan 3945*, near fire plot 47, 12.iv.1999 (DNA); *J.D.Briggs 934*, UDP Falls, 14.v.1983 (AD, CANB); *J.Brock 196*, Graveside Gorge, 31.xii.1986 (DNA); *N.Byrnes 1387*, UDP Falls, 20.2.1969 (NT); *I.D.Cowie 8993*, c. 62 km SW Maningrida, 18.iii.2000 (DNA); *R.Hinz 8*, Nabarlek, George Falls, 2.xii.1987 (DNA); *R.A.Kerrigan 427*, 2 km S Myra Falls, 27.iii.2002 (DNA); *K.H.L.Key et al. s.n.*, 6 km SWS Oenpelli, 30.v.1973 (CANB, DNA); *P.Martensz AE674*, 1.5 km SW Cannon Hill, 2.ii.1973 (CANB, DNA, NT); *P.Martensz & R.Schodde AE711*, 1 km N Red Lily Lagoon, 3.ii.1973 (CANB, NT); *A.A.Munir 5854*, 10 km S Oenpelli, 24.v.1988 (AD, DNA); *R.Pullen 9441*, Cahills Crossing, 2 vi.1974 (CANB, DNA); *J.Z.Weber 9872*, 10 km S Oenpelli, 25.v.1988 (AD, DNA); *G.M.Wightman 4279*, Nhulunbuy, 22.ii.1988 (BRI).

35b. *Hibbertia fractiflexa* subsp. *serotina* Toelken, *subsp. nov.*

A subspeciebus aliis sine brachyblastis, floribusque singularibus et staminibus majoribus (usque ad 26) et antheris 1.6–1.8 mm longis differt.
Typus: Northern Territory, near Sandy Creek Falls, *R.A.Kerrigan 844*, 24.v.2004 (holo.: AD; iso.: DNA – *n.v.*)

Scrambler with mainly long shoots, little branched and without short shoots. Leaves 3.4–5.7 mm broad, obtuse, rarely rounded, with recurved vein-end; with (20–) 22–28 scales across the mid-upper surface and large scales 0.22–0.3 mm in diameter. Flowers 1 per axillary shoot usually with reduced short shoot and/or leaves; outer calyx lobes 4.5–4.6 mm long; inner calyx lobes 4.4–4.7 mm long; 24–26 stamens and anthers 1.6–1.8 mm long. *Flowering*: May.

Distribution and ecology. Grows on steep rocky slopes with *H. brevipedunculata* and *H. lepidota* in open woodland with *Eucalyptus tetrodonta* and *Callitris*, known only from Sandy Creek Falls in Litchfield National Park, Northern Territory (A).

Conservation status. Known only from one locality but conserved in Litchfield National Park.

Variation. The subsp. *serotina* is here described, despite being based on only a single collection and the striking, but superficial resemblance to subspp. *fractiflexa* and *brachyblastis*. Its larger flowers (petals up to 9.3 mm long) and the almost complete absence of short shoots along the branches, which are bare and with only a few distal leaves, fall well outside the range of variation of these subspecies.

A specimen, *C.R.Dunlop 9872 & P.K.Latz* from Moyle River, has a similar habit with bare basal stems and without obvious short shoots, as well as scales of a similar size though fewer across the upper leaf surface. As this specimen is, however, without flowers it could not be identified with certainty.

Etymology. The epithet "serotina", Latin, "that comes or happens late", refers to the receipt of this valuable specimen late in the preparation of the manuscript.

Specimen examined

NORTHERN TERRITORY: *C.R.Dunlop 9872 & P.K.Latz*, Moyle River, 11.v.1994 (DNA) (without flowers).

35c. *Hibbertia fractiflexa* subsp. *brachyblastis* Toelken, *subsp. nov.*

A subsp. fractiflexa *squamis pluribus minoribus; a subsp. filicaule squamis pluribus foliisque plerumque latioribus; a subsp.* serotina *brachyblastis basalibus, floribusque minoribus antheris brevioribus differt.*

Typus: Northern Territory, 18 km NNE Jabiru East, *L.A.Craven 6348*, 4.vi.1980 (holo.: CANB; iso.: DNA, MEL, NSW, PERTH).

Hibbertia sp. 1 Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988).

Hibbertia sp. 5 K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996).

Hibbertia sp. decumbent (*P.Martensz 513*): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Scrambler or shrublet mainly with basal short shoots with/without few long shoots. *Leaves* (2.3–) 3.5–6 (–13.2) mm broad, acute to shortly acuminate, with terminal vein-end scarcely recurved and with very few terminal simple hairs, with (22–) 28–34 (–36) scales across the mid-upper surface and large scales 0.15–0.25 mm in diameter. *Flowers* (1) 2 or 3 (–5) borne on ± developed axillary short shoots with at least some acute leaves; outer calyx lobes 3.1–3.3 mm long; inner calyx lobes 4.2–4.45 mm long; 16–20 (–22) stamens and anthers 1.1–1.3 mm long. *Flowering*: December–June. **Figs. 2C & 14A–C**.

Distribution and ecology. Found in widely different habitats but usually grows in sandstone crevices of rock pavement, scree or spreading over rock faces in wetter areas in gorges or along creeks, but usually in scrub vegetation often under woodland or on margins of *Allosyncarpia* forest. Frequently recorded from the upper and lower central western escarpment of the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Locally frequent in Kakadu National Park.

Diagnostic features. Although some specimens of *H. brevipedunculata* are superficially similar and may even have scattered narrow-rimmed scales as well as almost terete flower buds (*I.D.Cowie 1365 & R.Booth*), they are distinguished from subsp. *brachyblastis* by being multistemmed erect plants with basal stems without short shoots and by having more than forty stamens.

Variation. The leaves of this subspecies are very variable and at times they are as broad as those of subsp. *fractiflexa* (e.g. *R.K.Harwood 298*), but they are may be as narrow as those of subsp. *filicaulis* (e.g. *L.A.Craven 5958*, *A.V.Slee & L.A.Craven 2732* and *I.D.Cowie 1148 & G.J.Leach* also show an intermediate range of the size of the leaves of typical subsp. *brachyblastis*). However, in each case the size and number of scales across the mid-upper surfaces of adult leaves sufficed to distinguish the three subspecies. Leaf width in itself can be a useful indicator of the subspecies, but it is rarely diagnostic.

Etymology. The many short shoots, which give the plants its characteristic decumbent appearance, are referred to in the epithet "brachy-blastis", Latinised Greek, "with short shoots" (noun in apposition, Ablative Plural).

Selection of specimens examined (52 seen)

NORTHERN TERRITORY: *L.G.Adams 2864*, 38 miles SSE Oenpelli, 18.vii.1972 (CANB); *D.Bowman 414 & B.Wilson*, Murgenella, 12.iv.1986 (DNA); *K.G.Brennan 243*, Podocarpus Gorge, 9.i.1990 (DNA); *I.D.Cowie 1365 & R.Booth*, 3.4 km W Shady Camp, 8.ii.1991 (DNA); *I.D.Cowie 8301*, East Aligator River, W of rock holes,20.iv.1999 (AD); *I.D.Cowie 1148 & G.J.Leach*, Upper Gimbat Creek, 19.iv.1990 (DNA); *L.A.Craven 5791*, 1 km S Twin Falls, 23.v.1980 (CANB, DNA, MEL); *L.A.Craven 5958*, 14 km NE Jabiru, 26.v.1980 (DNA); *A.V.Slee 2732 & L.A.Craven*, 19.5 km ENE Mary River Ranger Station, 21.iv.1990 (AD, DNA); *R.K.Harwood 298*, Jabiluka, 10.ii.1998 (DNA); *D.Jones 1449*, near Mt Howship, 20.ii.1984 (DNA); *M.Lazarides & L.G.Adams 174*, gorge near Plum Tree Creek, 11.iii.1965 (NSW, NT); *Martensz & Schodde AE 513*, 4 miles N El Sharana, 23.i.1973 (BRI, DNA, NT); *J.Russell-Smith 1117*, Ibangu, 9.ii.1984 (DNA); *A.V.Slee & L.A.Craven 2732*, 19.5 km ENE Mary River Station, 21.iv.1990 (CANB); *I.R.Telford 7594 & J.W.Wrigley*, Obiri Rock turnoff, 18.iv.1980 (CANB); *H.S.Thompson 321*, Ja Ja, 29.iv.1983 (CANB); *J.Z.Weber 9835 & 10089*, ca 25 km SE Murgenella, 5.vi.1988 (AD, DNA).

35d. *Hibbertia fractiflexa* subsp. *filicaulis* Toelken, *subsp. nov.*

A subspeciebus aliis foliis angustissimis (1.1–2.2 mm latis) et ramis filiformibus differt.

Typus: Northern Territory, sources of Goomadeer River, *T.S.Henshall 1980*, 13.vi.1978 (holo.: AD; iso.: DNA, MEL, NSW, CANB; NT – *n.v.*).

Scrambler with some basal short shoots but usually also with few long shoots. *Leaves* 1.1–2.2 mm broad, acute to acuminate, with terminal vein-end not or scarcely recurved, with long simple hairs, with 10–16 scales (large scales 0.11–0.15 mm in diameter) across the mid-upper surface of leaves. *Flowers* 1, 2 (3) on ± developed axillary short shoots with at least some acute leaves; outer calyx lobes 2.2–2.6 mm long; inner calyx lobes 3.5–3.7 mm long; with 16–19 stamens and anthers 1.1–1.3 mm long. *Flowering*: February–June. **Fig. 14E**.

Distribution and ecology. Growing in sandy soil among boulders in scrub vegetation in open woodland but also in *Allosyncarpia* forest; localised on western escarpment of Arnhem Land Plateau, Northern Territory (A).

Conservation status. Rare.

Variation. An extremely localised form, which is, however, judging by present records sufficiently distinct from subsp. *brachyblastis* to deserve taxonomic rank. Only the leaves of the short shoots of the two subspecies are similar, while the long linear leaves of long shoots are always distinct from those of the latter subspecies.

Only the first two leaves of seedlings (*J.L.Egan 4796 & S.Knox)* are broadly rhombic-oblanceolate (up to 8.2 mm broad) and have a single lobe on either side of the upper third as would be typical of juvenile leaves of this group. The third leaf is entire and narrowly elliptic (up to 4.8 mm broad), although still slightly broader than the

leaves that followed (2.1–2.8 mm broad). No dimorphic leaves are observed on regenerating branches of any of the subspecies of this species.

The tomentum of these first leaves consists of scattered rosette-like fascicled hairs with unequally long arms, some of which are considerably longer than others on hairs mainly on the margins. The hairs on the vein-ends have each usually only one long arm and thus appear to be simple. The sparse rosette-like fascicled hairs on the epicotyl and branch above have not widely differing arms and are more or less laterally fused to form characteristic narrow-rimmed scales by the fourth or fifth leaf. Only scales are found on the sixth or seventh leaf.

Etymology. The epithet "fili-caulis", Latin, "thread-like branched" seems appropriate for the slender branches of this subspecies although they may become stiffly wiry when old.

Specimens examined

NORTHERN TERRITORY: *L.A.Craven 2465*, sandstone plateau, 2.iii.1973 (CANB, NT); *J.L.Egan 4796 & S.Knox*, 7 km NNE Jabiru, 25.iv.1995 (DNA).

2.5. *H. stirlingii* subgroup

Vestiture: *leaves* with unequal spreading to reflexed rosette-like hairs/rarely scales with unequal branches, ± unilaterally enlarged on apical vein-ends, denser (except *H. stirlingii*) abaxially. *Calyx* with marginal unilaterally enlarged cilia becoming very fine and similar to marginal fascicled cilia with 1 or 2 arms on inner calyx lobes of some species. *Shrubs* spreading, woody branches ± ridged. *Leaves* linear to linear-oblanceolate, with recurved to revolute margins, with central vein slightly raised; juvenile leaves without teeth or lobes. *Flowers* usually terminal; buds spherical on straight thread-like peduncle, scarcely recurved (nodding fruit). Anthers (10–) 20–35 (–46), subequal 0.7–1.3 mm long (except 2.3–3.5 mm in *H. stirlingii*).

Diagnostic features. Species of the *H. stirlingii* subgroup are distinguished by their straight, usually somewhat woody branches and straight spreading slender peduncles, which bear small spherical flower buds. All species have narrow to linear leaves.

Content. Species 36–42. *H. oligocarpa*, *H. extrorsa*, *H. scabrifolia*, *H. stelligera*, *H. stirlingii*, *H. pilulis*, *H. malleolacea*.

Notes. Three species are found on the central western escarpment of the Arnhem Plateau (NT) and the other two occur in the mountains south of Cape York Peninsula (Qld) south to near Townsville.

The contrast of quite rigid branches with the often extremely fine spreading peduncle bearing spherical flower buds as well as the narrowly oblong leaves with revolute margins are characteristic of this subgroup. The *H. stirlingii* subgroup is a number of species within the §*Tomentosae* for which lobed leaves on coppicing branches or seedlings have not yet been recorded although specimens of obviously coppicing plants are known for a few species. Further observations are needed to ascertain whether this stage is completely absent in all these species, or is it reduced to only a few leaves or brought on by certain conditions. Like the previous group it has unilaterally enlarged cilia on the calyx and on the apical vein-ends of the leaves of most of the species, spherical flower buds and subequal stamens typical of the *H. tomentosa* group.

The predominantly terminal flowers of these species, which are regarded as a primitive character, as well as the flowers turned downwards when open (at least in *H. pilulis* and *H. malleolacea*) indicate a pollination syndrome unique in *Hibbertia*. These flowers are wide open unlike those of *H. pallidiflora* Toelken (*H. aspera* group, Toelken 1998), the only other hibbertia species known with pendulous flowers.

The two very similar but often confused species, *H. stelligera* and *H. stirlingii,* have a very different androecium. The former has 20–35 small stamens with anthers 0.7–1.3 mm long, as is typical for the *H. stirlingii* subgroup, but the latter has only 10–12 anthers, each 2.3–3.5 mm long. This is unusual among these species, but is possibly determined by a different pollination syndrome.

36. *Hibbertia oligocarpa* Toelken, *sp. nov.*

A speciebus aliis Hibbertiae stirlingii *subturmae habitu decumbente, 46–58 staminibus pistillisque quattuor; a* H. tomentosa *lobis calicis apicis rotundatis, > 40 staminibus pistillisque quattuor differt.*

Typus: Northern Territory, 10 km SW Oenpelli, *J.Z.Weber 9908*, 25.v.1988 (holo.: AD; iso.: CANB, DNA).

Shrublet with few stems, trailing or scrambling; branches almost terete with scarcely raised leaf base, shortly hirsute or spreading pubescent. Vestiture persistent, of rosette-like ± broad-based fascicled hairs on vegetative parts including bracts and mainly relatively small broad-rimmed fascicled hairs on the calyx; *on branches* dense, rarely moderately dense, with ± similar, spreading rosette-like ± broad-based fascicled hairs (7–11 unequal arms, some often considerably longer); *on leaves above*, dense, with subequal spreading rosette-like broad-based fascicled hairs (7–9 subequal arms); *on leaves below*, very dense, with ± similar, fine spreading broad-based fascicled hairs (7–11 subequal arms): *on bracts* very dense above and below, with rosette-like ± broad-based fascicled hairs (9–12 unequal arms spreading to erect-spreading below) becoming larger towards the margins; *on outer calyx lobes* dense to very dense, outside with larger scales centrally becoming smaller towards the margins and overtopped by scattered very large rosette-like broad-based fascicled hairs (12–16 unequal arms) mainly along the centre and unilaterally enlarged cilia along the margins, inside glabrous; *on inner calyx lobes* very dense, outside, with larger scales often overtopped by

scattered larger scales in the centre becoming smaller towards the membranous margins with fascicled cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.2–1.1 mm, often indistinct; *lamina* narrowly elliptic-oblanceolate, rarely oblanceolate, (5.3–) 6.5–13 (–23.4) × (2.2–) 2.5–3.5 (–8.4) mm, obtuse with short tomentose vein-end, becoming rounded, gradually tapering into petiole, flat with recurved margins, entire, above slightly grooved along the central vein pubescent, below with slightly raised central vein, rarely with almost straight intramarginal veins and tomentose to shortly hirsute, discolourous; juvenile leaves not seen. *Flowers* mainly single terminal but also in distal clusters on main branches with some short shoots, with buds spherical; *peduncle* thread-like, (4.6–) 6–10 (–11.4) mm long, terete; *bracts* linear-elliptic to -oblanceolate, 1.5–2.2 × 0.5–07 mm, less than half as long as the outer calyx, acute, indistinctly ridged, above hirsute-pubescent, below shortly hirsute. *Calyx* with lobes unequal; *outer calyx lobes* (2) broadly oval, (2.6–) 2.8–3.5 (–4.1) × 2.5–2.9 (–3.2) mm, slightly shorter than inner ones, obtuse becoming rounded, ridged, outside densely scaly and with unilaterally enlarged cilia, inside glabrous; *inner calyx lobes* (3) broadly oval to depressed-oval, 4.3–4.9 (–5.2) × (4.7–) 5.2–5.9 (–6.1) mm, rounded, without central ridge, outside densely scaly and with marginal cilia on the membranous margins, inside glabrous. *Petals* broadly obovate, 5.2–7.6 mm long, deeply bilobed. *Stamens* 46–58 (without staminodes), subequal, ± in groups around ovaries; *filaments* filiform, (0.8–) 1.1–1.5 (–1.7) mm long, scarcely connate basally; *anthers* obloid, 0.8–1.2 mm long, abruptly constricted above and below. *Pistils* (3–) 4; *ovaries* obovoid, each with 2 basal ovules, sparsely scaly, with filiform style attached to the apex towards the outer margin of the pistils then curved out-, up- and again inward with the stigmas just above the anthers. *Fruiting peduncle* elongating, slightly recurved. *Seeds* broadly obloid 2.1–2.2 × 2.0–2.1 mm, black or brown; *aril* with fleshy attachment expanding into a cup-like lobed membrane clasping the lower third of the seed. *Flowering*: May. **Fig.15J**.

Distribution and ecology. Trailing and scrambling over rocks near waterfall in northern Northern Territory (A).

Conservation status. Very rare.

Diagnostic features. H. oligocarpa is unusual in the *H. stirlingii* subgroup, because of its decumbent habit, flat leaves with scarcely recurved margins, short peduncles (resembling those of the *H. orbicularis* or *H. alopecota* subgroups) and, more importantly, usually four pistils. It is, however, placed here because of the following combination of characters: terete branches, fine hairs and large scales being relatively small, flowers mainly single terminal, spherical buds even in fruit, filiform peduncles, short linear bracts, outer calyx lobes glabrous inside, more than 40 short anthers each with pale smooth (not brown and rugose) surface, and the absence of staminodes.

The species differs from others in the *H. stirlingii* subgroup by its decumbent habit, flat ± membranous leaves with scarcely recurved margins, 46–58 stamens, and four pistils per flower. Superficially it resembles *H. tomentosa*, but is easily distinguished by its rounded calyx lobes, more than 40 stamens and usually four pistils.

Variation. The leaves on the main branches with long internodes are much larger but with similar dense vestiture on the undersurface of the leaves as on senescent branches. No juvenile leaves were seen.

Etymology. The epithet "oligo-carpa", Latinised Greek, "few-fruited" refers to the (3) 4 pistils, each developing separately, while most hibbertias usually have only two follicles per flower.

Specimens examined.

Known only from the type collection.

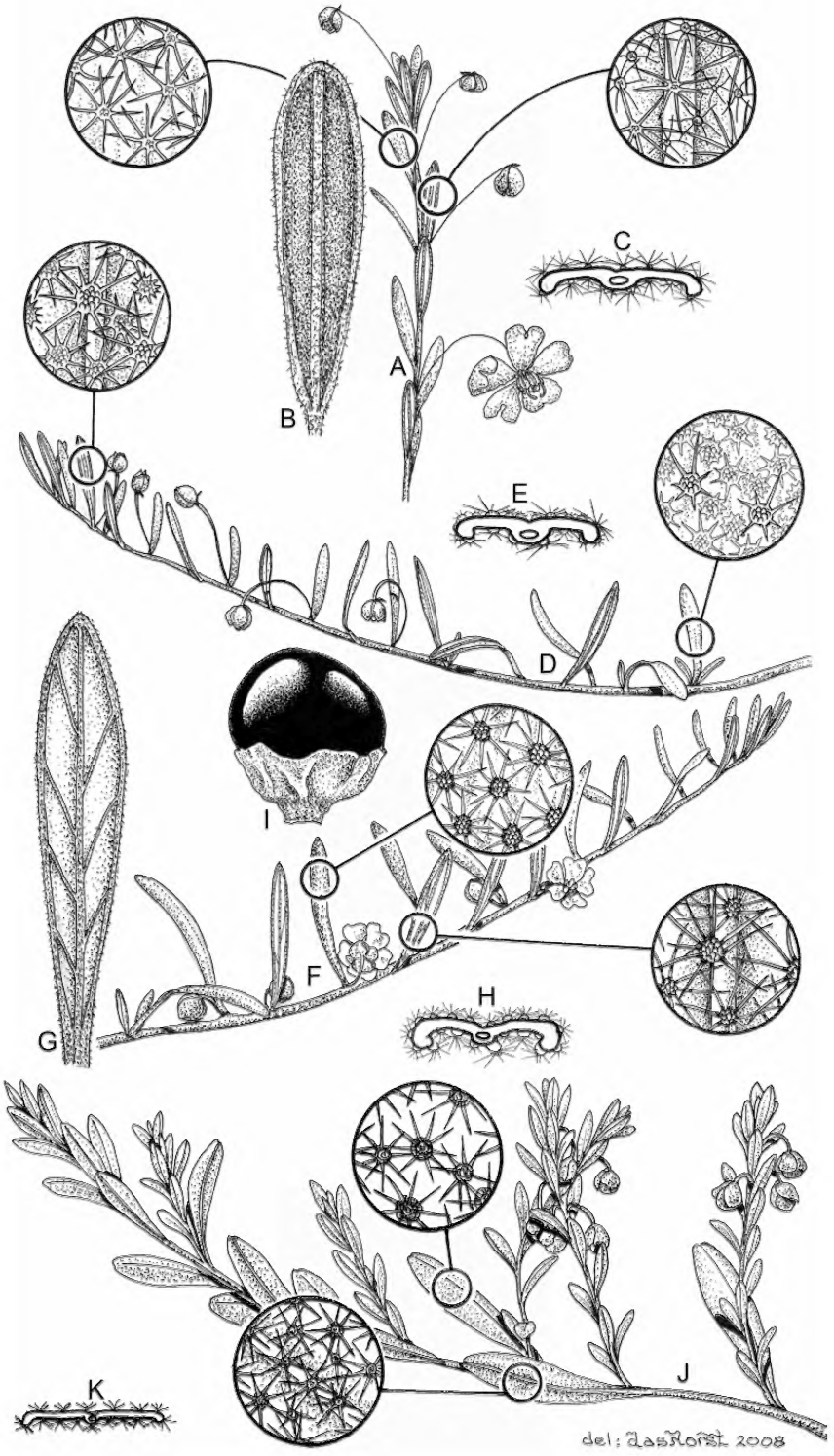
37. *Hibbertia extrorsa* Toelken, *sp. nov.*

Hibbertiae malleolaceae *similis sed floribus in brachyblastis axillaribus bracteisque et lobis externis calicis acuminatis vel acutis;* H. lepidotae *similis sed tomento pilorum stelatorum marginibusque recurvatis et venis centralibus prominentibus foliorum; a* H. brevipeduncula*ta ramis lignosis, floribus parvis et lobis externis calicis acutis differt.*

Typus: Northern Territory, Upper Birdie Creek, *A.V.Slee & L.A.Craven 2496*, 18.iv.1990 (holo.: CANB; iso.: AD).

Shrublets to 0.4 m tall, spreading to sprawling; branches terete or faintly ridged, shortly hirsute to pubescent. *Vestiture* persistent, larger over smaller ± reflexed rosette-like broad-based fascicled hairs on vegetative parts and ciliate- and/or entire scales on the calyx; *on branches* moderate to dense, with few larger over smaller ± reflexed rosette-like broad-based fascicled hairs (5–14 subequal arms especially on larger hairs); *on leaves above* moderate, with few larger mainly towards the flanks of the revolute margins over/ with scarcely smaller reflexed rosette-like broad-based fascicled hairs (8–13 subequal arms); *on leaves below* dense, with scattered larger mainly on central vein and revolute margins over smaller (often scarcely broad-based) reflexed rosette-like broad-based fascicled hairs (8–15 subequal arms); *on bracts* above with ciliate to entire scales and on upper two-third and margins with some hairs (not ciliate) and below with few larger over smaller reflexed to spreading rosette-like broad-based fascicled hairs; *on outer calyx lobes* outside dense, with scattered reflexed rosette-like broad-based

Fig. 15 (next page). **A–C *H. malleolacea***: **A** flowering branch ×1; **B** leaf from below ×3; **C** transverse section through mid-leaf ×10. **D–E *H. scabrifolia***: **D** fruiting branch ×1; **E** transverse section through mid-leaf ×10. **F–I *H. extrorsa***: **F** flowering branch ×1; **G** leaf from below ×5; **H** transverse section through mid-leaf ×10; **I** seed ×12. **J *H. oligocarpa***: fruiting branch ×1. — **A–C** *M.A.Lazarides 8996*; **D, E** *J.Z.Weber 9908*; **F, H, I** *A.V.Slee & L.A.Craven 2496*; **G** *K.G.Brennan 3631*; **J** *J.Z.Weber 9908*.


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del: daSilva 2008

fascicled hairs mainly along central ridge and margins over narrow-rimmed peltate scales and with a row of unilaterally enlarged fascicled hairs on the margins, inside with larger over smaller spreading rosette-like usually broad-based fascicled hairs; *on inner calyx lobes* outside dense, with ciliate to entire peltate scales and few marginal fascicled cilia along the membranous margins, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0–1.4 mm long, indistinct; *lamina* linear, linear-elliptic, rarely linear-oblanceolate, (8.9–) 9–18 (–26.6) × (0.8–) 1.0–2.5 (–5.4) mm, acute rarely becoming bluntly acute to rounded and with tufts of unilaterally enlarged fascicled hairs on the vein-end, gradually tapering into petiole, entire, above ± grooved along the central vein and tomentose, below with raised central vein and partial lateral ones as well as revolute margins, tomentose to velutinous, discolourous; juvenile leaves not seen. *Flowers* 1 or 2 (3), "axillary", often with one rudimentary leaf or rarely terminal on short shoots, with spherical buds surrounded by spreading apices of bracts and outer calyx lobes; *peduncle* slender but stiff, 1.3–3.4 mm long, angular; *bracts* lanceolate, (1.2–) 1.9–2.3 × (0.7–) 1.0–1.2 mm, acute, rarely acuminate, usually with recurved spreading apex, ± ridged, pubescent rarely velvety above and below and some short unilaterally enlarged cilia. *Calyx* with lobes unequal; *outer calyx lobes* ovate, 3.1–3.5 (–3.9) × 2.0–2.5 mm, scarcely longer than inner ones, acute to ± acuminate, with recurved and spreading apices, scarcely ridged, outside ± reflexed fascicled hairs over densely scaly and unilaterally enlarged cilia on the margins, inside shortly hirsute to pubescent; *inner calyx lobes* oblong-obovate, 2.8–3.4 × 2.4–3.1 (–3.5) mm, rounded, without ridge, membranous margin with ± fine fascicled cilia, densely peltate-scaly outside, inside glabrous. *Petals* cuneate-obovate, 2.8–3.5 (–3.7) mm long, deeply bilobed. *Stamens* ca 30 (without staminodes but sometimes up to 3 anthers very small and apparently indehiscent) subequal, in bundles around ovaries; *filaments* filiform, 0.8–1.4 mm long, scarcely connate basally; *anthers* obloid, 0.6–1.0 mm, abruptly constricted above and below, slightly incurved. *Pistils* 2; ovaries depressed obovoid, each with 2 (3) basal ovules, densely peltate-scaly, with style attached to central to anterior apex curving back- and upwards then forward and down to place the constricted stigma above the anthers. *Fruiting peduncle* scarcely elongating, sparsely recurved. *Seeds* obovoid to almost spherical, 2.1–2.3 × 2.1–2.25 mm, black or brown; *aril* with scarcely fleshy base expanding into a cup-like sheath (scarcely to gently lobed) covering the lower third of the seeds. *Flowering*: March–April. **Fig. 15F–I**.

Distribution and ecology. Recorded from sand in small depressions on dissected sandstone in "open woodland with scattered spinifex" in Upper Birdie Creek area on the Arnhem Land Plateau, Northern Territory (A).

Conservation status. Unknown.

Diagnostic features. The fascicled hairs on linear leaves of this species are similar to those of *H. malleolacea*, but in *H. extrorsa* there are also scattered prominently larger fascicled hairs overtopping the dense tomentum of the leaves, and the central vein is raised to the level of the recurved margins. More importantly, it is distinguished by its axillary flowers with short peduncle and more or less recurved to spreading, acuminate apices of the bracts and outer calyx lobes.

Variation. As in *H. malleolacea* the basal leaves on fast growing branches are much larger than the more numerous ones at the end of flowering branches. Judging by this, the type specimen must have been picked from an old plant with most of its leaves being small.

Etymology. The epithet "extrorsa", Latin, "turned away from the centre, axis" refers to the recurved spreading outer calyx lobes and the bract found in this species, which is unusual in the *H. stirlingii* subgroup.

Specimens examined

NORTHERN TERRITORY: *K.G.Brennan 3631*, 5 km E of Jim Jim Jumpup, 9.iii.1999 (DNA); *T.M.Orr 380*, NE Sleisbeck, 19.3.1990 (DNA).

38. *Hibbertia scabrifolia* Toelken, *sp. nov.*

A H. stelligera *pilis cactiformibus dense tectis et bracteis ovatis amplexicaulibus; a* H. pilulis *fruticibus densis bracteis ovatis foliorumque paginis inferis non tomentosis differt.*

Typus: Western Australia, Morgan River on Theda Station, *P.A.Fryxell, L.A.Lazarides & J.McD.Stewart 4859*, 18.vi.1985 (holo.: CANB).

Shrubs to 0.6 m tall, much branched above the base, decumbent; branches scarcely ridged from the centre of the leaf base, pubescent to sparsely hirsute. *Vestiture* persistent, rosette-like to cactiform broad-based fascicled hairs on vegetative organs and mainly peltate scales on calyx; *on branches* moderately dense, with scattered scarcely larger spreading (rarely erect) rosette-like broad-based (thin-based on young regenerating branches) fascicled hairs (4–8 usually unequally long arms, some often very short) interspersed with slightly smaller mainly cactiform ones; *on leaves above* dense, with subequal mainly cactiform (and rarely with 2–5 unequal arms at odd angles but mainly antrorse, or latrorse especially those closer towards the margins); *on leaves below* dense, with scattered larger spreading rosette-like broad-based fascicled hairs (9–12 subequal arms) mainly on the recurved margins and central vein over finer larger and smaller rosette-like to cactiform ± broad-based fascicled hairs on the undersurface; *on bracts* above and below ± dense, with few scattered reflexed rosette-like broad-based fascicled hairs to ciliate scales over smaller cactiform ones and marginal unilaterally enlarged cilia; *on outer calyx lobes* outside mainly with narrow-rimmed peltate scales with cactiform fascicled hairs and more or less unilaterally enlarged fascicled hairs usually with only a few longer arms on the margins, inside with moderately dense cactiform

fascicled hairs on the slightly recurved lip-like upper fifth; *on inner calyx lobes* outside dense, with larger over smaller peltate scales and often without marginal cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0–0.8 mm long, indistinct; *lamina* linear-oblanceolate, (5.6–) 6–13 (–16.5) × 1.1–2 (–2.6) mm, acute to bluntly acute, recurved apex with few bristles of unilaterally enlarged fascicled hairs, with cuneate base, entire, above with slight depression along the central vein and densely stubble-like, below with moderately raised central vein and ± recurved margins, usually sparsely hirsute, scarcely discolourous; juvenile leaves (regenerating) of similar shape and size and tomentum on the upper surface as adult ones, but undersurface sparsely covered with spreading rosette-like fascicled hairs. *Flowers* 1, terminal becoming leaf-opposed, on all branches, with buds almost spherical; *peduncle* thread-like, 6.5–14.7 mm long, terete; *bracts* ovate, eared to almost clasping peduncle, 1.1–1.25 × 0.95–1.15 mm, acute to obtuse, stubble-like with few spreading unilaterally cilia on margins. *Calyx* with lobes unequal; *outer calyx lobes* (2) oblong-obovate, 2.3–2.8 × 2.4–2.8 mm, considerably shorter than inner ones, pointed apex slightly recurved or rounded with membranous margins, appressed, without ridge, outside densely scaly and unilaterally enlarged cilia to fascicled cilia, inside glabrous; *inner calyx lobes* (3) broadly oblong-obovate, 2.8–4.4 × 2.5–3.4 mm, rounded and with membranous margin, outside without ridges, densely scaly and a few marginal cilia, inside glabrous. *Petals* narrowly cuneate-obovate, 2.5–3.3 mm long, deeply bilobed. *Stamens* (17–) 20–22 (without staminodes on partly eaten flower examined), subequal, in bundles around the ovary; *filaments* filiform, 0.8–1.2 mm long, scarcely connate basally; *anthers* obloid, 0.95–1.1 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with style attached to the apex then curved up-, out- and again more or less inward placing the stigmas well above the apex of the anthers. *Fruiting peduncle* slightly elongating and recurved. *Seeds* not seen. *Fruiting*: April (May). **Fig. 15D, E**.

Distribution and ecology. "Locally common on sandstone" in eucalypt woodland with *Hibbertia oblongata* subsp. *brevifolia*, *Triodia* spp. *Chrysopogon ambiguus* and *Actinoschoenus* sp. in northern Western Australia (NK).

Conservation status. "Locally common on sandstone" (*P.A.Fryxell et al. 4859*).

Diagnostic features. Clasping bracts are usually associated with species of *H. alopecota* and *H. oblongata* subgroups, but the narrow leaves, the absence of lobed juvenile leaves, the long thread-like peduncle as well as its cactiform fascicled hairs, which often get more or less dorsiventrally flattened, are all characters of the *H. stirlingii* subgroup. *Hibbertia scabrifolia* is superficially similar to *H. stelligera* from northern Queensland, but distinguished by its decumbent habit, ovate bracts clasping the peduncle, the cuneate-obovate petals and usually a longer peduncle. The mainly cactiform fascicled hairs differ from the fully expanded ones in both *H. malleolacea* and *H. pilulis* as well as from the small flattened scales of *H. stirlingii*.

Variation. The tomentum of the vegetative parts of this specimen varies greatly from short-hirsute to almost tomentose on young leaves and branches to stubble-like surfaces on mature ones. Young new branches from the somewhat woody base and the undersurface of the first few leaves are sparsely covered with spreading mainly few branched fascicled hairs. The upper leaf surface of these first leaves is usually distinctly more densely covered than the undersurface with rosette-like and cactiform fascicled hairs. Although the overall denseness of the tomentum on the upper surface is generally similar to that of adult leaves there are usually more rosette-like fascicled hairs on juvenile leaves and the number of well-developed arms of fascicled hairs are rapidly reduced acrotoniously. This results in considerable variation on the same plant. A similar phenomenon was also observed in some specimens of the very similar *H. stelligera* (e.g. *P.I.Forster 14917*, which has similar wiry branches unusual for that species).

The length of the peduncle also shows a large range of variation and, although it tends to be longer than that of *H. stelligera*, it is not a character that will definitely identify the one or other.

Etymology. The epithet "scabri-folia", Latin, "rough-leaved" refers to the rough texture, due to the cactiform fascicled hairs commonly on the upper leaf surface. Even more unusual of this species is the coarse undersurface of the leaves also due to rough mainly cactiform fascicled hairs.

Specimen examined.

WESTERN AUSTRALIA: *M.D.Barrett 2024*, 4.9 km E new Theda Homestead, 24.iv.2008 (PERTH).

39. *Hibbertia stelligera* (C.T.White) Toelken, *comb. & stat. nov.*

Hibbertia stirlingii C.T.White forma *stelligera* C.T.White, Proc. Roy. Soc. Queensland 47: 51 (1936); Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007). — **Typus**: Queensland, Cook district, *L.J.Brass 1888*, 1.i.1932 (lecto. – selected here: BRI 180887, left-hand branch; iso-lecto.: BRI 180887, 2 branches to the right of lectotype; presumed iso-lecto.: MEL 35832; QRS 27697 [but in error *L.J.Brass 1885*] – cf. Typification); Range Road, *Miss Wheatley 117*, 5.vii.1934 (syn.: BRI 180891, QRS 27698).

Shrubs up to 0.5 m tall, multistemmed from a ± branched rootstock (rhizo-stolon) and usually much branched aerial parts; branches scarcely ridged from the centre of the leaf base, pubescent to puberulous or stubble-like. *Vestiture* persistent, with rosette-like to cactiform broad-based fascicled hairs (rarely to ciliate-peltate scales) on vegetative parts and narrow- to broad-

rimmed scales on the calyx; *on branches* moderate to dense, with scattered larger reflexed to spreading rosette-like broad-based fascicled hairs (7–12 unequally long arms some of which are very short) over smaller usually cactiform ones, rarely only cactiform ones and/or dense narrow-rimmed scales on the leaf bases and petioles; *on leaves above* sparse to moderately dense, with scattered larger and few or no smaller rosette-like to/or cactiform broad-based fascicled hairs (8–14 subequal to unequal arms); *on leaves below* moderately dense to rarely sparse, with scattered larger rosette-like and/or rarely cactiform broad-based fascicled hairs mainly on the recurved margins and central vein over scattered smaller often very reduced cactiform fascicled hairs mainly on the undersurface; *on bracts* above and below moderately dense, with larger cactiform to narrow-rimmed ciliate-peltate over smaller cactiform fascicled hairs to narrow-rimmed peltate scales and ± unilaterally enlarged marginal cilia at least at the base; *on outer calyx lobes* outside dense, with larger over smaller peltate scales and with unilaterally enlarged to fascicled cilia on margins, inside glabrous; *on inner calyx lobes* outside dense, with broad- over narrow-rimmed peltate scales and often fine marginal cilia often with simple hairs, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* (0–) 0.2–0.6 (–1.1) mm long; *lamina* linear, rarely linear-oblanceolate, (4.1–) 7–19 (–42.1) × (0.6–) 0.8–2.2 (–4.9) mm, obtuse to bluntly acute, recurved vein-end with fascicled hairs or rarely bristle-like erect unilaterally enlarged hairs, gradually tapering into petiole, entire, above slightly reflexed along the central vein and pubescent, puberulous to stubble-like, below with ± raised central vein and recurved to revolute margins, pubescent, puberulous to ± stubble-like (often wearing off), discolourous; juvenile leaves (coppicing) similar to adult leaves but usually about twice as long, with tomentum above and below progressing from very few to many multiangulate to reflexed rosette-like or cactiform fascicled hairs (cf. Variation below). *Flowers* 1, terminal becoming leaf-opposed, or rarely also "axillary" with reduced leaves at the base of the peduncle on rapidly growing branches, with buds spherical; *peduncle* ± thread-like, (3.4–) 6–9 (–11.6) mm long, terete; *bracts* oblong to oblong-elliptic, 2.3–2.7 × 0.9–1.25 mm, shorter than outer calyx lobes, usually obtuse, ciliate-scaly and/or entire scales. *Calyx* with lobes unequal; *outer calyx lobes* (2), obovate to orbicular, 2.4–2.8 × 2.3–2.7 mm, half as long to longer than inner ones, rounded, appressed, scarcely ridged, with membranous margins, outside densely scaly and with unilaterally enlarged cilia, inside stubble-like towards the apex; *inner calyx lobes* (3) broadly obovate, 3.6–4.7 × 4.2–4.8 mm, rounded, without ridges and usually without or with very short cilia on the membranous margin, outside densely scaly; inside glabrous. *Petals* obovate, 6.4–11.2 mm long, usually deeply bilobed. *Stamens* 20–32 (without staminodes), subequal, in bundles around the ovaries; *filaments* filiform, 1.1–1.6 mm long, scarcely connate basally; *anthers* narrowly obloid, 0.7–1.3 mm long, ± abruptly constricted above and below. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with style attached to outer apex then curving up- and outward, and again inward to place constricted stigmas above the anthers. *Fruiting peduncle* scarcely elongating, recurved. *Seeds* obovoid, 2.8–3.1 × 3.0–3.2 mm, black; *aril* with fleshy attachment expanding into a cup-shaped sheath (scarcely lobed) covering more than half of the lower seed. Flowering: mainly December–May. **Fig. 16A–D**.

Distribution and ecology. Grows in well-drained sandy soils on granite, usually associated with heath-like vegetation in open eucalypt woodland or often riparian forest in northern Queensland (Co, Nk).

Conservation status. Widespread and locally frequent.

Diagnostic features. H. stelligera is very similar to *H. stirlingii*, but is distinguished by the combination of more or less well developed fascicled hairs on the vegetative parts, a peduncle shorter than 12 mm, and 20–30 anthers, each 0.7–1.3 mm long. It also differs from the Western Australian *H. scabrifolia* by the widely spaced fascicled hairs on the upper leaf surface, the oblanceolate to elliptic bracts (ovate in the latter). *Hibbertia stelligera* is furthermore distinguished from *H. malleolacea* and *H. pilulis* (both from the Northern Territory) by its small dense habit (straggly erect to 2 m tall for the last two), without its densely tomentose undersurface being different from the recurved margins and central vein, and by fruiting peduncles, which are shorter than 12 mm.

Variation. *Hibbertia stelligera* is a very variable species and the present delimitation of the species must be reassessed with more material; especially some of the isolated forms need to be more closely evaluated for potential infraspecific taxa. The greatest variation is observed in the morphology of the trichomes varying from fascicled hairs with long spreading to short arms as in cactiform hairs or the occasional narrow-rimmed peltate scales on leaves (cf. Fig. 16). This species is here distinguished from *H. stirlingii* by the number and size of the anthers rather than the presence of fascicled hairs as opposed to scales, as originally interpreted by White (1936) with limited material. A range of intermediates between fascicled hairs and scales can be found in the southern form particularly on plants from the Paluma Range (*W.R.Birch JCU S-5070; E.M.Jackes JCU S-13676*). Moreover the length of the peduncle as a distinguishing character between these two taxa was overrated in the protologue. Similarly, the presence of fascicled hairs on the apex of the leaves in *H. stelligera* as opposed to simple hairs in *H. stirlingii*, was not effective for all specimens to separate the two taxa. Furthermore, scales are usually smaller in *H. stirlingii* (< 0.25 mm in diameter) and thus commonly distinguishable from those of *H. stelligera* (normally

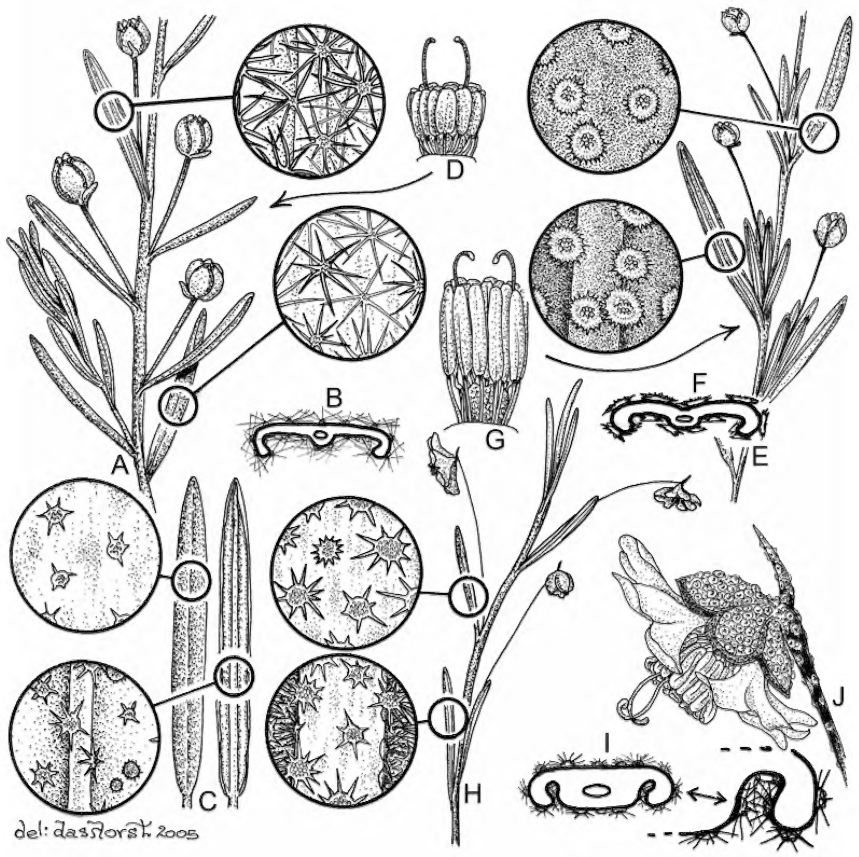


Fig. 16. A–D *H. stelligera*: **A** flowering branch ×1; **B** transverse section through mid-leaf ×10; **C** variation of tomentum on leaves ×1; **D** flower with calyx and corolla removed ×6. **E–G *H. stirlingii***: **E** flowering branch ×1; **F** transverse section through mid-leaf ×10; **G** flower with calyx and corolla removed ×6. **H–J *H. pilulis***: **H** flowering branch ×1; **I** transverse section through mid-leaf ×10; **J** nodding flower in side view ×8. — **A**, **B**, **D** *B.Hyland 10382*; **C** *W.W.Abell BRI 176333*; **E–G** *P.I.Foster 14678*; **H–J** *K.G.Brennan 9426.*

0.3–0.4 mm in diameter) Even these scales found on the inner calyx lobes of *H. stirlingii*,, cannot be used on all specimens but, like all these characters, they helped to define the two species.

The species consists of a northern inland form (mainly from near Ravenshoe to north of Mareeba) in which most of the fascicled hairs bear long arms at least when young. In the southern coastal form, recorded from near Ingham and the Paluma Range, most of the fascicled hairs never develop any arms and the cactiform hairs thus closely resemble narrow-rimmed scales, or in other cases form scales similar to those of *H. stirlingii*, a species which occurs almost sympatrically with the northern form. No taxonomic rank was, however, given to these forms, because no additional distinguishing characteristic could be found, particularly as plants from Wallamans Waterfall (near Ingham) have many fascicled hairs and so have juveniles leaves (see below).

The specimen *P.I.Forster 14917* (near Copperfield River Kidston Goldmine, Gilbert Range) has unusually wiry branches, but even more importantly it is densely pubescent to tomentose on the undersurface of the leaves, which is the usual quick distinction for *H. malleolacea* and *H. pilulis* from the Northern Territory, while the two Queensland species, *H stirlingii* and *H. stelligera*, are sparsely hairy and/or scaly. A similar plant is recorded from Pentland Hill (without collector, MEL 695462), but the exact locality could not be established, nor have more recent collections confirmed this southernmost extention. Both specimens must be identified as *H. stelligera*, and they are possibly separate subspecies. They are distinguished from *H. extrorsa*, a species with similar coarse hairs on the undersurfaces from the Northern Territory, by their appressed apices of the bracts and outer calyx lobes. More collecting is needed before these forms can be fully evaluated.

Although plants are generally much branched, they usually produce several little-branched straight erect stems, which will eventually branch at the apex (*B.R.Jackes JCU S-8080, S-13568*) when regenerating from a slightly woody base after fires. Regenerating or coppicing plants (*Svenson s.n.*, Paluma Range) show on

their leaves and branches the whole range of variation in hair types: from multiangulate fascicled hairs (2, 3 often unequal arms) to a gradual increase in number of arms (7–9 usually equal arms), which are then more or less arranged in a regular circle and have their bases enlarged and bulging. These more or less spreading rosette-like broad-based fascicled hairs often have 1–3 broad bases (without arms) in the centre, indicating that most likely the arms have already been reduced to papillae in a similar way to the reduction of the arms on cactiform fascicled hairs. This is the next step in the development of the hairs on these plants.

While the youngest leaves of these coppicing branches have very few widely scattered hairs, older ones develop an increasingly dense tomentum. A similar concurrent increase in the number of hairs was also observed on the branches. It would seem that the few hairs on the undersurface of leaves of most specimens of both *H. stelligera* and *H. stirlingii* represent a retention of a juvenile character (see also *H. orbicularis* subgroup).

Typification. Hibbertia stirlingii forma *stelligera* was described by reference to characters in the description of the species. Of the two collections (syntypes) cited and annotated by White (1936), *L.J.Brass 1888* (BRI 180887) is the more complete specimen, especially the left hand branch, which was here selected as the lectotype of the species. The duplicate in MEL was not annotated by White. A Brass collection at QRS is accepted as duplicate of the type, although it was numbered *L.J.Brass 1885*, presumably in error, since all the information agrees with that of the lectotype; a Wheatley syntype is also present in QRS. The consecutive numbering of these two specimens shows that they were presented to QRS at the same time as the two syntypes of the forma *stelligera*.

Selection of specimens examined (33 seen)

QUEENSLAND: *W.W.Abell 78*, Burra Range, NW Burra between Pentland and Torrens Creek, v.1974 (BRI); *W.R.Birch s.n.*, Paluma to Hidden Valley, 28.v.1972 (JCU S-5070); *S.T.Blake 18816*, near Wallamans Falls, 14.viii.1951 (BRI, CANB); *H.Flecker 5368 & 5526*, Wild River Valley, Herberton, 26.xii.1938 (AD, QRS); *P.I.Forster 9490*, 17 km past Paluma on road to HiddenValley road, 22.i.1992 (AD); *P.I.Forster 14917*, dam near Copperfield River Goldmine, 25.ii.1994 (AD); *B.Hyland 10382*, Baal Gammon Mining Lease, 29.iii.1980 (QRS); *E.M.Jackes s.n.*, Mt Zero, 17.i.1989 (JCU S-13676); *Miss Lamont s.n.*, Herberts Rock, 1889 (MEL); *H.S.McKee 9369*, Davies Creek, 29.iv.1962 (BRI, CANB); *G. & N.Sankowsky 839 & 840*, Wild River, 30.iii.1988 (BRI); *G.L.Stebbins A-78*, 13 km W Paluma, 2.i.1972 (CANB).

40. *Hibbertia stirlingii* C.T.White

Proc. Roy. Soc. Queensland 47: 51 (1936). — *Hibbertia stirlingii* forma *squamulosa* C.T.White, Proc. Roy. Soc. Queensland 47: 51 (1936), nom. illeg., includes type of species (cf. Typification). — *Hibbertia stirlingii* forma *stirlingii*. S.T. Reynolds, Queensland Vasc. Pl. 100 (1994); Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007). — **Typus**: Queensland, Cook district, Herberton, *J.Stirling s.n.*, vii.1904 (holo.:BRI 11533).

Shrubs to 0.6 m tall, moderately branched, with main stems stiffly woody; branches ± ridged from the centre of the leaf base, with scattered scales. *Vestiture* persistent, with narrow-rimmed scales on vegetative organs as well as some broad-rimmed ones on the calyx; *on branches* with scattered narrow-rimmed peltate scales of similar size; *on leaves above and below* with scattered (to dense on petiole and leaf base) narrow-rimmed peltate scales of similar size ± evenly spread on both surfaces, with few bristles (reduced unilaterally enlarged hairs) on the terminal vein-end but wearing off soon; *on bracts* ± dense, with narrow-rimmed peltate scales of about similar size on both surfaces, rarely with unilaterally enlarged ciliate scales on basal margins; *on outer* and *inner calyx* lobes dense, with larger broad-rimmed (rarely more than 0.25 mm in diameter) over smaller scales usually unilaterally enlarged on the outer lobes and sparser fascicled cilia on the inner ones. *Leaves* without axillary tufts of hairs; *petiole* 0.4–1.5 (–2.6) mm long, densely covered with peltate scales, but scarcely overtopping margins; *lamina* linear, (3.6–) 7.5–19 (–40.4) × (0.8–) 1.2–2.0 (–2.8) mm, pointed or acute with straight vein-end covered with bristle-like reduced unilaterally enlarged fascicled hairs, scarcely constricted into petiole, entire, almost flat or commonly with revolute margins, above scarcely reflexed along the central vein and with scattered peltate scales, below with ± raised and often somewhat broadened central vein as well as with scarcely ridged revolute margins and evenly covered with scattered peltate scales, scarcely discolourous; juvenile leaves not seen. *Flowers* terminal, becoming leaf-opposed, rarely terminal on axillary branches and/or on short shoots with ± reduced leaves and "axillary", with buds spherical to ellipsoidal or obovoid when fruiting; peduncle thread-like, (9.4–) 12–19 (–24.3) mm long, ± terete; bracts linear-elliptic or -oblanceolate, (1.4–) 1.9–2.3 (–2.5) × 0.5–0.8 (–2.1) mm, acute to bluntly acute, ± densely scaly on both surfaces and sometimes with short unilaterally enlarged marginal cilia at least basally. *Calyx* with lobes unequal; *outer calyx lobes* (2) oblong-obovate to orbicular, 2.4–3.3 × 2.2–3.0 mm, more than half as long as the inner ones, rounded with membranous margins, without central ridge, appressed, outside densely scaly and with short unilaterally enlarged marginal cilia, inside sparsely stubble-like distally; *inner calyx lobes* (3) obovate to oblong-obovate, 4.2–5.7 × 4.1–5.2 mm, rounded with membranous margins, without central ridge, outside densely scaly and with very short marginal fascicled cilia sometimes only at the apex, inside glabrous. *Petals* obovate, 7.2–9.6 (–10.7) mm, deeply bilobed. *Stamens* 10–12 (without staminodes), subequal, in groups around the ovaries; *filaments* strap-like, 0.6–0.9 mm long, scarcely connate basally; *anthers* ellipsoidal to ellipsoid-obloid, 2.5–3.5 mm, acute and tapering to both ends. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovule,

densely scaly, with style attached to the outer apex curving up- and outward, then again inward placing the constricted stigmas just above the apex of the anthers. *Fruiting peduncle* elongating considerably, spreading with apparently nodding fruit. *Seeds* obovoid to almost spherical, 2.9–3.2 × 2.8–3.0 mm, black; *aril* with fleshy attachment expanding into a cup-like sheath (scarcely lobed) covering the lower half of the seed. *Flowering*: January–June. **Figs. 1K & 16E–G**.

Distribution and ecology. Grows usually on coarse sandy soil often with gravel associated with granite under eucalypt woodland or open forest in northern Queensland (Co, Nk).

Conservation status. Locally frequent.

Diagnostic features. *Hibbertia stirlingii* is superficially similar to *H. malleolacea*, *H. pilulis*, *H. scabrifolia* and *H. stelligera,* but distinguished by the combination of scattered narrow-rimmed peltate scales on the leaves and branches, no dense tomentum on the undersurface of the leaves, as well as fewer anthers, which are twice as long and dehiscing mainly by terminal pores.

Variation. Flowers of this species are often terminal on the main branches, but in actively growing plants they are also found on axillary short shoots (e.g. *B.Hyland 5858*). On older plants with relatively short leaves they are rather close to one another so that a distinction between short and long shoots is sometimes difficult.

Typification. White (1936) designated *J.Stirling s.n.* a holotype of *H. stirlingii.* It is then irrelevant for the typification of the species that he quoted two specimens, *J.Stirling s.n.* and *T.L.Bancroft s.n.* under *H. stirlingii* forma *squamulosa*, which Reynolds (1994) corrected to forma *stirlingii*.

Selection of specimens examined (32 seen)

QUEENSLAND: *L.J.Brass 33792*, junction of Herberton, Irvinebank & Stannary Hills roads, 4.v.1968 (QRS); *F.H.J.Crome 371*, 8 mls E Herberton, 29.iii.1972 (CANB); *S.Dixon NSW 224840*, near Herberton, vi.1899 (NSW); *P.I.Forster 6278*, 2 km past Mt Misery on road to Silver Valley, 24.ii.1990 (AD, BRI); *P.I.Forster 18400 & T.Ryan*, Deadmans Road, 3.ii.1996 (AD, QRS); *B.Hyland 5858*, near Ord Railway Station, 27.i.1972 (BRI, QRS); *B.Hyland 5929*, near Barkerville, 17.iii.1972 (BRI, CANB, QRS); *A.N.Rodd & M.Hardie 4491*, Stannary Hill Road, S.Mutchilba, 21.iv.1985 (BRI, CANB, NSW); *G.& N.Sankowsky 836*, Jumna Creek, 2.iv.1988 (BRI); *H.v.d.Werff 11581*, Watsonville to Stannary Hills, 24.v.1990 (QRS).

41. *Hibbertia pilulis* Toelken, *sp. nov.*

Hibbertiae stirlingii *similis sed foliis linearibus subtus tomentosis, floribus terminalibus in ramis principalibus antherisque 0.5–0.7 mm longis; a* H. malleolacea *foliis tenuis marginis perrevolutis nervisque centralibus prominentibus, et pedunculis longioribus differt.*

Typus: Northern Territory; Deaf Adder Gorge, *C.R.Dunlop 5457*, 22.iv.1980 (holo.: AD; iso.: BRI, CANB, DNA, MEL, NSW, PERTH).

Hibbertia sp. 5 Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988).

Hibbertia sp. 12 K.Brennan, Ann. Checklist Vasc. Plants Alligators Rivers Region 45 (1996).

Hibbertia sp. fine pedicel (*R.Schodde 83*) R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrub up to 2 m tall, with slender woody branches, spindly to weeping when young; branches distinctly ridged from the centre of the leaf base, pubescent to stubble-like. *Vestiture* persistent, with rosette-like to cactiform broad-based fascicled hairs on vegetative organs and peltate scales on the calyx; *on branches* moderate to dense, with scattered rosette-like to usually cactiform broad-based fascicled hairs (8–12 unequal rarely subequal arms: shorter to one side); *on leaves above* moderate to dense, with scattered subequal reflexed rosette-like to cactiform broad-based fascicled hairs (6–12 subequal to unequal short arms) and with spreading hairs on the apical vein-end; *on leaves below* dense to very dense, with scattered rosette-like to cactiform broad-based fascicled hairs on the revolute margins and central vein over finely tomentose with mainly thin-based but also some broad-based rosette-like hairs on the undersurface; *on bracts* above and below moderate to dense, with scattered larger and smaller spreading rosette-like broad-based fascicled hairs and ± unilaterally enlarged ones on margins; *on outer calyx lobes* outside very dense, with peltate scales sometimes overtopped by larger ciliate-peltate scales mainly along the central ridge, usually with unilaterally enlarged cilia on the margins, inside glabrous; *on inner calyx lobes* outside densely covered with larger and smaller peltate scales and rarely with fine marginal fascicled cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.2–0.6 (–1.1) mm long, indistinct; *lamina* linear, linear-oblanceolate, (4.7–) 10–30 (–47.6) × (0.4–) 0.8–1.8 (–3.7) mm, acute to obtuse or only with slightly recurved vein-end with scarcely expanded terminal tufts of hairs, hardly constricted into thick petiole, entire, above with distinct groove along the central vein, pubescent to stubble-like, below with revolute margins about as broad as raised central vein usually covering up the velutinous to tomentose undersurface, rarely discolourous when undersurface visible; juvenile leaves not seen. *Flowers* terminal becoming leaf-opposed on main branches without short shoots, with buds ± spherical; *peduncle* thread-like, 14.3–43.2 mm long, terete; *bracts* linear, linear-triangular, 1.3–1.6 × 0.2–0.35 mm, acute, below and above stubble-like with a few fascicled hairs centrally. *Calyx* with lobes unequal; *outer calyx lobes* (2) broadly obovate to almost orbicular, 2.6–2.9 × 2.6–2.8 mm, shorter than inner ones, rounded and with marginal membrane often with fine unilaterally enlarged cilia, without central ridge, outside densely scaly, inside glabrous; *inner calyx lobes* (3) almost orbicular, 4.6–5.1 × 3.7–4.2 mm, with rounded apex and membranous margins topped with fine fascicled cilia, without central ridge, outside densely scaly, inside glabrous. *Petals* broadly obovate, 9.5–11.7 mm long,

deeply bilobed. *Stamens* 34–46 (without staminodes, but with very small not-dehisced anthers), subequal, in several bundles around ovaries; *filaments* filiform, 0.7–1.0 mm long, scarcely connate basally; *anthers* broadly obloid, 0.7–1.1 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with style attached to apex curved out- and upwards, then inwards to place the constricted stigmas well above the anthers. *Fruiting peduncles* elongating and remaining straight. *Seeds* broadly obovoid, 1.7–1.8 × 2.1–2.2 mm, black; *aril* with fleshy attachment and short scarcely lobed sheath covering less than a third of the seeds. *Flowering*: December–June. **Fig. 16H–J**.

Distribution and ecology. Grows in sand and usually associated with mixed scrub vegetation on top of the central western parts of the Arnhem Land Sandstone Plateau, Northern Territory (A).

Conservation status. Rare.

Diagnostic features. This species shares the long filiform peduncle with *H. stelligera* and *H. stirlingii* (Queensland), *H. malleolacea* (Northern Territory) and *H. scabrifolia* (Western Australia), but *H. pilulis* is distinguished by its linear leaves with strongly revolute margins, so that the dense fine hairy undersurface (velutinous to tomentose and with usually not obviously broad-based fascicled hairs as in forms of *H. stelligera*) is covered between revolute margins and the equally broad, raised central vein.

The flowers of both *H. pilulis* and *H. malleolacea* are turned downwards. The long peduncles are usually very much longer than the subtending leaves and do not recurve when fruiting as typical in the §*Tomentosae*. The fruits seem to nod at the end of the peduncle.

Variations. The leaves on young branches and, in particular, on a young main axis are much larger than those of flowering branches, as is typical of this group. Such leaves usually have fascicled hairs with well-developed arms on all exposed surfaces, but they become progressively shorter towards the distal leaves. Ultimately cactiform fascicled hairs are found on leaves of flowering branches, as was also observed in forms of *H. stelligera*. Similarly to that species, some of the fascicled hairs of *H. pilulis* become difficult to distinguish from small narrow-rimmed peltate scales. This is particularly true of plants from Mt Gilruth area (*T.S.Henshall 1865*) because they often become more or less sunken on the upper surface of leaves.

Etymology. Plants of this species are often covered with small spherical flower buds on long peduncles. The epithet "pilulis" is derived from a diminutive of "pilula", Latin, "small ball", and thus describes the plant as a "*Hibbertia* with little balls" (noun in apposition, ablative plural).

Selection of specimens examined (37 seen)

NORTHERN TERRITORY: *K.G.Brennan 3042*, 23 SSE Jabiru airstrip, 18.iii.1995 (DNA); *K.G.Brennan 3629*, 5 km E Jim Jim Jumpup, 9.iii.1999 (DNA); *I.D.Cowie 8245*, SE Graveside Gorge, 16.iii.1999 (AD, CANB, DNA); *L.A.Craven 6098*, tributory of Deaf Adder Creek, 29.v.1980 (BRI, CANB, DNA, MEL, NSW, PERTH); *L.A.Craven 6267*, 17.5 km SSE Koongarra, 2.vi.1980 (CANB, DNA, MEL); *L.A.Craven & G.M.Wightman 8289*, near Mt Gilruth, 27.iii.1984 (AD, CANB, DNA, NE); *C.R.Dunlop 5674*, top of Jim Jim Falls, 30.i.1981 (BRI, CANB, DNA, MEL, NSW); *T.S.Henshall 1865*, Mt Gilruth area, 5.vi.1978 (CANB, NSW, NT); *R.Schodde AE83*, Deaf Adder Basin, 10.vi.1972 (BRI, CANB, DNA, NT); *I.R.Telford 7976 & J.W.Wrigley*, Deaf Adder Creek Gorge, 22.iv.1980 (AD).

42. *Hibbertia malleolacea* Toelken, *sp. nov.*

Hibbertiae stelligerae *similis sed habitu effuso foliis planis linearo-oblanceolatis, bracteis linearo-triangularibus pedunculisque fructicantibus non recurvatis; a* H. pilulis *pilis fasciculatis, foliis planis linearo-oblanceolatis pedunculisque brevioribus differt.*

Typus: Northern Territory, 11.5 km NE Jabiru, *M.Lazarides 8996*, 26.vi.1980 (holo.: AD; iso.: CANB, DNA, MEL, NSW, PERTH).

Hibbertia sp. 6 Lazarides et al., Checklist Flora Kakadu Nat. Park 15: 12 (1988).

Hibbertia sp. Northern Outliers (*L.A.Craven 6550*): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrub up to 1 m tall, little branched, straggly; branches terete or slightly ridged from the leaf base, tomentose rarely hirsute. *Vestiture* persistent, spreading or rarely erect rosette-like broad-based fascicled hairs on branches, leaves and bracts, and/or peltate scales on the calyx; *on branches* ± dense, with scattered larger over smaller erect to spreading rosette-like broad-based fascicled hairs (6–12 often unequally long arms); *on leaves above* moderate to dense with subequal spreading rosette-like broad-based fascicled hairs (8–12 subequal arms); *on leaves below* denser than above, with similar larger ones mainly on the slightly recurved margins and raised central vein with slightly smaller but not much denser and mainly broad-based fascicled hairs on the undersurface; *on bracts* moderately dense, with spreading rosette-like broad-based hairs on both surfaces; *on outer calyx lobes* outside dense, with scattered spreading rosette-like broad-based hairs along the upper centre and on the margins grading into unilaterally enlarged cilia over dense peltate scales towards the base, inside glabrous; *on inner calyx lobes* outside with few or no reflexed rosette-like broad-based fascicled hairs over dense peltate scales and some marginal fascicled cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.2–1.2 mm long; *lamina* elliptic, elliptic-oblanceolate, (4.6–) 10–20 (–41.7) × (0.7–) 2–4.5 (–7.8) mm, rounded, often with fine vein-end with short hair tuft, gradually constricted into petiole, flat or margins slightly recurved, entire, above without veins and sparsely tomentose, below with slightly raised central vein and often straight intramarginals visible close to the margins, usually tomentose, discolourous; juvenile leaves (*B.Harwood 160*) entire, much longer than those commonly found on flowering branches, puberulous

to pubescent becoming ± tomentose. *Flowers* terminal becoming ± leaf-opposed, on all branches, with spherical buds becoming often slightly pyriform when fruiting; *peduncle* filiform, (4.6–) 6–16 (–20.2) mm long, terete to slightly compressed below fruit; *bracts* linear-lanceolate, rarely linear-oblanceolate, 1.1–1.4 × 0.5–0.8 mm, shorter than outer calyx lobes, acute, flat, appressed, pubescent above, tomentose below. *Calyx* with lobes unequal; *outer calyx lobes* (2) obovate, rarely oblong-obovate, 2.4–2.9 × 1.6–1.9 mm, usually about half as long as inner ones, rounded, appressed, without central ridge, outside densely ciliate-scaly and/or scaly and with unilaterally enlarged cilia on the margins, inside glabrous; *inner calyx lobes* (3) oblong-obovate, 4.2–4.5 × 2.8–3.3 mm, longer than outer ones, with rounded often fascicled cilia apex on ± membranous margins, outside densely scaly, inside glabrous. *Petals* broadly obovate and almost clawed, 4.4–5.8 mm long, deeply bilobed. *Stamens* 28–32 (without staminodes), subequal, in bundles around the ovaries; *filaments* filiform, 1.1–1.3 mm long, scarcely connate basally; *anthers* broadly obloid, 0.7–0.9 mm long, abruptly constricted above, but below more gradually constricted, ± straight. *Pistils* 3; *ovaries* broadlyobovoid to almost spherical, each with 2 basal ovules, densely covered by peltate scales, with styles attached to the outer apex then curved up with constricted stigma well above the anthers. *Fruiting peduncles* elongating, scarcely recurved below the fruit and often appear nodding. *Seeds* obliquely obovoid, 1.8–2 × 1.5–1.8 mm, black; *aril* with somewhat laterally placed fleshy attachment expanding into short scarcely lobed sheath covering not even one-third of the seed. *Flowering*: December–June. **Fig. 15A–C**.

Distribution and ecology. Grows in crevices in sandstone usually on top of the Arnhem Land Plateau in heath often associated with *Allosyncarpia* forest, restricted to just north-east of Jabiru, Northern Territory (A).

Diagnostic features. The taxon has spreading fruiting peduncles similar to those found in *H. pilulis*, but *H. malleolacea* is distinguished from that species, as well as from *H. stelligera*, by its flat oblanceolate tomentose leaves, each with a scarcely raised central vein. Like in *H. guttata*, the intramarginal veins of leaves are usually visible close to and often accentuated by a depression between them and the margin. *Hibbertia malleolacea* differs from that species by its dense fascicled hairs, almost spherical flower bud and smaller anthers, and absence of brown hairs in the leaf axils.

Variation. As in *H. pilulis*, leaves on the main axis are considerably larger than those on most flowering branches and juvenile leaves vary similarly to that species in producing few small fascicled hairs at first. The tomentum becomes only gradually denser with each individual hair producing more arms. The specimen *B.Harwood 160* shows the first flowers on a plant, possibly in its first year, with juvenile leaves still attached to the base.

The peduncle of *H. malleolacea* is often not completely pushed into the leaf-opposed position as it is usually observed in *H. guttata*.

Etymology. Each spherical flower bud is borne on a long straight peduncle. This structure resembles a drumstick or more specifically a mallet as used for larger drums, and this explains the epithet "malleol-acea", Latin, "mallet-resembling".

Specimens examined

NORTHERN TERRITORY: *L.G.Adams & P.Richardson 3022*, 9 km NE Jabiru, 19.ii.1973 (CANB, NT); *K.G.Brennan 1657*, Hollow Rock, 17 km ENE Jabiru airstrip, 8.xii.1991 (DNA); *K.G.Brennan 3920*, 3 km SE Mt Howship, 3.iv.1999 (DNA); *K.G.Brennan 6187*, Northern outliers, near Fire Plot 144, 18.iii.2004 (DNA); *L.A.Craven 6488*, 15 km NNE Jabiru, 7.vi.1980 (CANB, DNA); *J.L.Egan 4845*, 10 km NE Jabiru, 27.iv.1995 (DNA); *B.Harwood 160*, 10 km S. Jabiru, 22.iii.1997 (DNA); *R.W.Johnson 4510*, 19 km E Jabiru, 18.vi.1989 (BRI); *R.A.Kerrigan 416*, Hollow Rock, 27.iii.2002 (DNA); *J.Russell-Smith 1061*, Kakadu Nat. Park, 2.ii.1984 (DNA).

2.6. *H. lepidota* subgroup

Vestiture: *on leaves* with fine appressed rosette-like hairs and/or usually membranous scales each with subequal or unequal arms resulting in often ± irregular scales; larger hairs/scales wrapped around abaxial petiole and apical vein-end and distinctly overtopping margins; much denser (usually several layers) on the abaxial surface and uppermost fascicled hairs and/or ciliate scales merging into peltate scales in deeper layers. *On calyx* with marginal unilaterally enlarged scales (often ± ciliate), rarely with fascicled cilia on inner calyx. *Branches* ridged to winged. *Leaves* with indistinct petiole, flat becoming ± incurved or folded lengthwise, with veins not visible. *Flowers* "axillary", buds spherical (rarely pyriform) with outer calyx lobes with recurved-spreading, usually acute apex. *Anthers* (10–) 18–33 (–38), subequal, 0.8–1.3 (–1.6) mm or rarely 2.3–2.5 mm in *H. pancerea*.

Diagnostic features. The large broad-rimmed scales, flat ciliate scales or rarely fascicled hairs, which are particularly wrapped around the abaxial surface of the petiole and the vein-end, are characteristic of the *H. lepidota* subgroup. Since the scales usually overtop the margins of the petioles and leaf lamina they become soon lacerated. The leaves of these species do not show clear veins and are usually folded more or less lengthwise along the midvein although the margins are not necessarily incurved.

Content. Species 43–52. *H. auriculiflora*, *H. ciliolata*, *H. lepidota*, *H. marrawalina*, *H. sulcata*, *H. pholidota*, *H. brennanii*, *H. argyrochiton*, *H. incurvata*, *H. pancerea.*

Notes. Most of the species are extremely localised mainly along the western escarpment of the Arnhem Plateau. The exception is *H. lepidota*, which is the most widespread species in the §*Tomentosae*, occurring in

many areas of northern Western Australia, Northern Territory and Queensland.

H. auriculiflora and *H. ciliolata* are unusual in this group, since they have mainly fascicled hairs to ciliate scales and it often takes detailed examinations to establish which of the two trichomes are present.. However, they are included here, because these fascicled hairs are broad-based and more or less appressed, especially on the abaxial side of the petiole and leaf apex. They also often have scale-like (though usually ciliate) unilaterally enlarged marginal hairs on the outer calyx lobes, which is characteristic of the *H. lepidota* subgroup.

Although this is a clearly outlined group, the *H. lepidota* subgroup is an extremely diverse group with branches varying from terete to obviously winged, terminal to "axillary" flowers, rosette-like fascicled hairs to ciliate and entire scales, and marginal unilaterally extended hairs with more or less connate rays. However, three main developments can be observed:

Firstly, plants with linear leaves, such as *H. lepidota*, *H. sulcata* and *H. marrawalina*, have gradually incurved leaf margins (U-shaped in transverse section) and usually smaller entire scales on the whole plant. *H. ciliolata* is an exception, because its leaves are scarcely incurved unless dessicated and ciliolate scales are common on plants.

Secondly, the species *H. brennanii*, *H. argyrochiton*, *H. incurvata* and *H. pancerea* have broader leaves, more or less ciliate scales on the abaxial leaf surface, and the leaves are, at least when dessicated, much more folded lengthwise (V-shaped in transverse section). The scales of the last mentioned species are usually larger and often become lacerated with age.

Thirdly, *H. pholidota,* the only Queensland endemic of this subgroup, has broad almost flat leaves and sparse coarser scales on the upper leaf surface, which more or less resemble those of *H. fractiflexa* of the *H. oblongata* subgroup. The somewhat membranous scales on the undersurface of the leaves are, however, not significantly dissimilar to the rest of the *H. lepidota* subgroup, especially as the larger scales on the petiole and the leaf apex clearly overtop their margins without being unilaterally enlarged. The species was therefore placed between the above two groupings with either U- or V-shaped leaves as representing an early isolation.

43. *Hibbertia auriculiflora* Toelken, *sp. nov.*

Hibbertiae ciliolatae *persimilis sed pilis fasciculatis in paginis adaxialibus foliorum ramis longioribus et patentibus, et praecipue squamis ciliolata; a* H. alopecota *similis sed foliis oblongis pilisque plus minusve adpressis in planta tota; a* H. oblongata *subsp.* brevifolia *1–3 floribus axillaribus in nodis sequentibus pilisque plus minusve adpressis planta tota differt.*

Typus: Northern Territory, Waterfall Creek, ca 2 km along creek above waterfall, *H.R.Toelken 9490*, 21.v.2004 (holo.: AD; iso.: BRI, CANB, DNA, PERTH).

Shrublet to 0.5 m tall, usually a short-lived perennial, erect to spreading; branches winged to ridged from the centre of the leaf base, ± velutinous. *Vestiture* persistent, with usually reflexed rosette-like broad-based fascicled hairs or rarely mixed with ciliate-peltate scales on the vegetative parts and outer calyx, and with scales only on the inner calyx lobes; *on branches* with ± dense spreading fascicled hairs (5–8 subequal arms) or ciliate scales (in subsp. *minor*) overtopped by larger reflexed rosette-like, very broad-based fascicled hairs (10–14 usually unequal arms); *on leaves above* dense and ± evenly covered with fine spreading to almost depresssed rosette-like moderately broad-based fascicled hairs (7–9 subequal arms); *on leaves below* very dense, with small rosette-like thin-based hairs (number of arms normally indiscernable) overtopped by few to many larger reflexed rosette-like broad-based fascicled hairs (9–14 subequal arms) often becoming ciliate narrow-rimmed scales (mainly in subsp. *minor*); *on bracts* above ± densely covered with reflexed rosette-like thin-based fascicled hairs (3–7 subequal arms), below denser, with appressed fascicled hairs and/or ciliate scales overtopped by reflexed rosette-like broad-based fascicled hairs; *on outer calyx lobes* outside dense, with ciliate/ciliolate scales overtopped by reflexed rosette-like broad-based fascicled hairs especially towards the margin where they become unilaterally enlarged cilia, inside ± dense, with rosette-like thin/broad-based fascicled hairs (7–13 subequal arms); *on inner calyx lobes* outside very dense, with smaller and larger peltate scale rarely overtopped by ciliate scales towards the margins and some become unilaterally enlarged cilia on parts without membranous margin. *Leaves* without axillary tuft of hairs; *petiole* 0–4.6 mm long; *lamina* oblong to linear, rarely narrowly elliptic-oblanceolate, 8.3–61.3 × 2.3–10.1 mm, cuspidate becoming rounded or emarginate as vein-end is recurved and densely covered with large ciliate scales, gradually tapering into petiole, entire, flat to incurved and ± folded lengthwise, above scarcely grooved above the central vein and densely pubescent, below with only the raised central vein visible and densely pubescent, slightly discolourous; juvenile leaves not seen. *Flowers* 1 or 2 (3), "axillary" with or without rudimentary leaves, along branches, with pyriform buds with appressed bracts but spreading outer calyx lobes; *peduncle* thread-like to strap-like but firm, 2.3–8.5 (–10.6) mm long, ± flattened; *bracts* elliptic to elliptic-oblanceolate, 3.1–4.5 (–5.6) × (1.4–) 1.6–2.1 (–2.5) mm, usually less than half as long as the outer calyx lobes, pointed and usually without terminal hairs, without obvious ridges, outside densely scaly overtopped by large reflexed rosette-like fascicled hairs particularly towards the margins. *Calyx* with unequal lobes; *outer calyx lobes* (2) oblanceolate to oblong-oblanceolate, 5.2–8.2 × 1.9–4.1 mm, longer than inner ones, acute to bluntly acute, slightly ridged, outside densely scaly overtopped with fascicled hairs and unilaterally enlarged cilia, inside pubescent; *inner calyx lobes* (3) obovate, 3.9–6.1 × 2.6–4.4 mm,

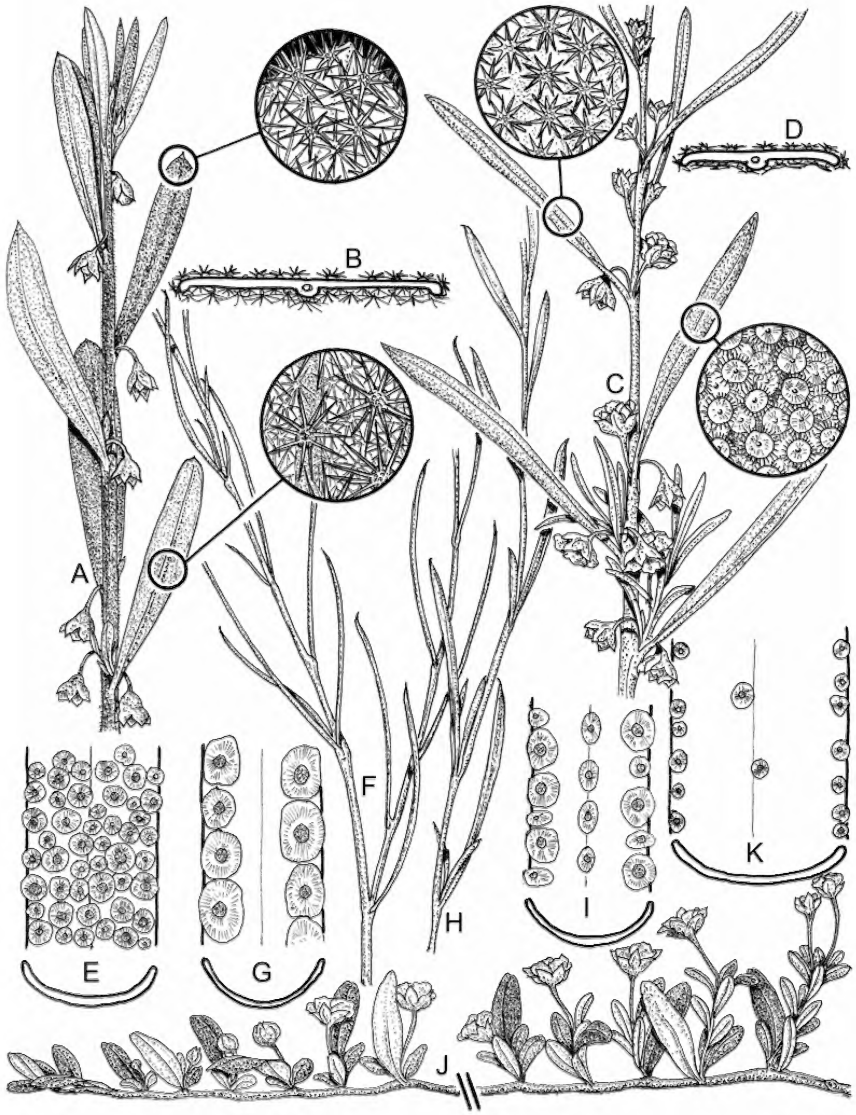


Fig. 17. A–B *H. auriculiflora* subsp. ***auriculiflora***: **A** flowering branch ×1; **B** transverse section through mid-leaf ×10. **C–D *H. ciliolata***: **C** flowering branch ×1; **D** transverse section through mid-leaf ×5. **E *H. lepidota***: many scales across the upper leaf surface ×9. **F–G *H. marrawalina***: **F** branch ×1; **G** 2 rows of scales along the upper leaf surface ×9. **H–I *H. sulcata***: **H** branch ×1; **I** 3 rows of scales along the upper leaf surface ×9. **J–K *H. pholidota***: **J** flowering branch ×1; **K** 3 irregular rows of irregular scales along the upper leaf surface ×9. — **A**, **B** *A.V.Slee & L.A.Craven 3056*; **C**, **D** *J.McKean 1042*; **E** *K.H.L.Key* CANB *249539*; **F**, **G** *C.R.Mitchell 4189*; **H**, **I** *K.G.Brennan 5750*; **J**, **K** *J.Dallachy MEL 1009750*.

rounded without ridges, outside densely scaly with some unilaterally enlarged cilia on the margins without membranous margin, inside glabrous. *Petals* obovate, 3.4–9.6 mm long, bilobed. *Stamens* 12–32 (without staminodes), subequal, in groups around the ovaries; *filaments* filamentous, 1.2–1.7 mm long, scarcely connate basally, *anthers* obloid, 0.9–1.6 mm, abruptly constricted above and below. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with styles attached to upper apex then curved up- and slightly outward and again bent down- and inward to place the constricted stigma at the apex of the anthers. *Fruiting peduncle* slightly elongating, recurved. *Seeds* obovoid to almost spherical, 2.5–2.65 × 2.2–2.3 mm, brown to black; *aril* with fleshy attachment expanding into a cup-shaped slightly fleshy sheath (scarcely lobed and ± crenulate) covering the lower third to half of the seeds.

Diagnostic features. *Hibbertia auriculiflora*, in particular the more erect habit of the typical subspecies, is very similar to that of *H. ciliolata*, but it differs by

Key to subspecies

1.

auriculiflora

1.

minor

43a. *Hibbertia auriculiflora* subsp. *auriculiflora*

Figs. 11 & 17A, B

43b. *Hibbertia auriculiflora* subsp. *minor* Toelken, *subsp. nov.*

Typus

18.iii.2004 (AD); *T.G.Hartley 13856*, 20 miles S Nabarlek, 30.vi.1973 (CANB); *R.Hinz 170*, Nabarlek, 4.ii.1989 (DNA); *D.L.Jones 1489*, Lightning Dreaming, 24.ii.1984 (CANB, DNA); *J.A.Risler & M.Waetke 1628*, veg. site 520, 18.iv.2001 (DNA); *A.V.Slee & L.A.Craven 2619*, ca 4 km S El Sharana, 20.iv.1990 (CANB).

44. *Hibbertia ciliolata* Toelken, *sp. nov.*

Hibbertiae auriculiflorae *persimilis sed squamis ciliata (rare pilis fasciculatis) adpressis;* H. lepidotae *similis sed vena centrale distincte elevata foliorum, pilis stelatis vel squamis ciliatis numerosis (20–30) trans paginas adaxiales foliorum; a* H. brevipedunculata *caule singulo et floribus minoribus bracteis et lobis calicis externis recurvatis differt.*

Typus: Northern Territory, vicinity of Woolaning H.S., *L.A.Craven & C.R.Dunlop 6657*, 4.iv.1981 (holo.: CANB; iso.: BRI, CANB, MEL).

Hibbertia sp. Woolaning (*L.A.Craven 6657*): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrub rarely up to 1 m tall, usually single-stemmed, little branched, erect; branches winged, rarely angled from the centre of the leaf base, moderately to densely scaly. *Vestiture* persistent, with mainly broad-rimmed peltate to ciliate-peltate scales on whole plant or rarely rosette-like broad-based fascicled hairs mainly on the upper leaf surface; *on branches* ± dense, with larger and smaller peltate scales or rarely larger ones ciliolate-peltate; *on leaves above* sparse and ± evenly covered (20–30 hairs/scales across the leaf) with subequal appressed rosette-like broad-based fascicled hairs (8–15 subequal arms) to ciliate-peltate scales; *on leaves below* very dense, with larger and smaller ciliolate-peltate scales rarely overtopped by a few larger scattered ciliate-peltate scales mainly on the central vein, with scales often inobtrusively overtopping the margins and with one or few subterminal cilia of ciliate scales unilaterally enlarged into terminal tufts; *on bracts* above with few scattered cactiform fascicled hairs to narrow-rimmed peltate or ciliolate-peltate scales, below densely covered by larger over (or rarely and) smaller peltate scales rarely overtopped by a few scattered ciliate-peltate scales mainly towards the apical margins, and with one rarely few terminal hairs; *on outer calyx lobes* outside ± dense, with larger and smaller peltate scales rarely overtopped by a few scattered ciliate-peltate scales mainly towards the apical margins, but then ± unilaterally enlarged and ± overtopping margins (but usually not ciliolate-peltate), inside with scattered usually narrow-rimmed ciliolate-peltate scales and/or rosette-like fascicled hairs at least on the upper half; *on inner calyx lobes* outside dense, with larger over smaller peltate scales ending in glabrous membranous margins with or without fascicled cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.5–3.2 mm long, indistinct, with densely scaly base; *lamina* linear-elliptic to -oblanceolate, (1.8–) 30–50 (–74.4) × (2.2–) 3.5–6 (–10.6) mm, acute to cuspidate, with recurved vein-end often with ciliate scales becoming bristle-like, rarely rounded, gradually constricted into petiole, entire, incurved to folded lengthwise, above grooved along the central vein and moderately fascicled-pubescent rarely ciliate-scaly, below with raised central vein and densely ciliolate-scaly, slightly discolourous; juvenile leaves not seen. *Flowers* 1–3 (–5), "axillary", with or without rudimentary leaves, rarely on obvious short shoots, along all branches, with pyriform buds topped by spreading bracts and outer calyx lobes; *peduncle* thread-like but firm, 2.2–9.5 (–12.6) mm long, ± flattened; *bracts* linear-triangular to lanceolate, linear-oblanceolate, 5–8.4 × 1.9–2.5 mm, pointed and usually with terminal tuft of hairs, recurved, slightly ridged, ± densely scaly margins ± ciliate. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate to ovate, 4.4–5.2 × 2.1–2.6 mm, usually longer than inner ones, acute to pointed or acuminate with incurving margins, with terminal "tuft of hairs", recurved, ridged, outside densely covered with peltate scales except for a few marginal unilaterally enlarged scales, inside with appressed rosette-like broad-based fascicled hairs on the upper half; *inner calyx lobes* (3) oblong-obovate, 4.1–4.9 × 2.2–2.9 mm, rounded and with membranous margin, without central ridge, outside very densely scaly and often a few marginal unilaterally enlarged fascicled cilia, inside glabrous. *Petals* cuneate-obovate, 4.5–6.2 mm long, broadly bilobed. *Stamens* 18–26 (without staminodes), subequal, in several bundles around the ovaries; *filaments* filiform to finely strap-like, 0.7–1.4 mm long, scarcely basally connate; *anthers* obloid, 1.2–1.6 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* broadly ovoid to almost spherical, each with 2 basal ovules, coarsely scaly, with styles attached to outer apex then curved out-, up- and again inward to place the constricted sigmas above the apex of the anthers. *Fruiting peduncle* slightly elongating, strongly recurved to coiled. *Seeds* broadly obovoid to almost spherical, 2.5–2.65 × 2.4–2.5 mm, dark brown; aril with fleshy attachment and enlarging into a slightly lobed sheath covering the lower third of the seed. *Flowering*: November–June. **Fig. 17C, D**.

Distribution and ecology. Grows on sand usually associated with sandstone or quarzite outcrops at the base of the escarpment, but also occasionally recorded from the plains as far west as Jasper Gorge, Northern Territory (A, K).

Conservation status. Locally frequent.

Diagnostic features. H. ciliolata is in habit similar to typical *H. auriculiflora*, but unlike this species it has usually only appressed ciliate scales and not spreading rosette-like fascicled hairs. The flowers are similar to those found in *H. lepidota*, but *H. ciliolata* is distinguished by its larger leaves with 20–30 ciliate-peltate scales and/or rosette-like fascicled hairs across the upper surface of the leaves. *Hibbertia ciliolata* usually has a ciliate-peltate/rosette-like vestiture adaxially together with very dense ciliolate-peltate scales abaxially, while in *H. lepidota* the adaxial scales are normally entire and, if ciliolate-peltate scales occur, they are found abaxially.

The prominently raised central vein on the undersurface of leaves, together with an obvious groove along the central vein on the upper surface, give them a keeled appearance (V-shaped in transverse section), in contrast to the leaves of *H. lepidota*, which are more furrowed (U-shaped) and without an obvious central vein.

Hibbertia ciliolata has large leaves as in *H. brevipedunculata* and they are also often covered with many ciliate-peltate scales, but the former is distinguished by its small flowers with distinctly acute and recurved bracts and two outer calyx lobes.

Variation. The leaves of *H. ciliolata* tend to be distinctly larger than those of *H. lepidota* at, for instance the Edith Falls (*M.Reed 19*). Leaves of specimens *H. ciliolata* recorded from Katherine Gorge (*L.A.Craven 6702*) fall well into the range of *H. lepidota*, but are distinguished by a greater number of usually rosette-like fascicled hairs and/or rarely ciliate scales across the upper surface. This applies particularly to some long-leaved forms of *H. lepidota*, also from near Katherine (*M. Lazarides 7037, H.S.McKee 8553*), with many shortly pedunculate flowers born on definite axillary short shoots. The much-branched habit, short leaves and small flowers of *R.W.Johnson 4541* (19 km E Jabiru) are similar to those of *H. lepidota*, but this specimen was included in *H. ciliolata* because the whole plant is covered with rosette-like fascicled hairs and/or ciliate scales.

Plants of *H. ciliolata* are usually sparse erect shrubs with a single stem so that the specimen *A.V.Slee & L.A.Craven 2497*, of which the habit is described as "sprawling shrub about 40 cm tall", is unusual, but the size of the leaves as well as the shortly pedunculate flowers are typical of this species.

Although *A.S.George 14102* (Gariyeli Creek, lower Prince Regent River, Western Australia) is very similar to this species there are indications that it could be a segregate species, but with incomplete material available it is at present placed in "Species insufficient known".

Etymology. The epithet "ciliolata", Latin, "scarcely ciliate", refers to the usually shortly ciliate peltate scales, which are particularly well developed and visible on the undersurface of leaves.

Specimens examined

NORTHERN TERRITORY: *A.C.Beauglehole 46578*, Jasper Gorge, 3.vii.1974 (CANB); *R.Booth 1401 & I.D.Cowie*, southern Lichfield Park, 13.ii.1996 (BRI); *J.D.Briggs 938*, 34 km from El Sharana on road to Pine Creek, 15.v.1983 (CANB); *N.Byrnes 2475*, Tipperary area, 26.i.1972 (CANB, NT); *I.D.Cowie 1206 & G.J.Leach*, headwaters of Haywood Creek, 4.v.1990 (AD, DNA); *L.A.Craven 6702*, Katherine Gorge, 6.iv.1981 (CANB, MEL); *L.A.Craven & G.M.Wightman 8260*, head of gorge Twin and Jim Jim Falls, 24.iii.1984 (AD, CANB); *C.R.Dunlop 4435*, Deaf Adder Gorge, 23.ii.1977 (CANB, DNA); *T.G.Hartley 13887*, Mt Basedow Range, 1.vi.1973 (CANB, NT); *D.A.Hearne 367*, 42 miles from Pine Creek on road to El Sharana, 12.i.1973 (DNA); *R.W.Johnson 4541*, 19 km E Jabiru, 18.vi.1989 (BRI); *R.A.Kerrigan 790*, ca 8 km SE Jim Jim Falls, 19.iii.2004 (AD); *G.J.Leach 3397*,Tumbling waters, 10.iii.1993 (BRI); *G.J.Leach 4154*, western end of Macadam Range, 22.ii.1994 (AD); *P.Martensz & R.Schodde AE 582*, 2-3 miles N El Sharana, 25.1.1973 (CANB, NT); *T.McKean 1042*, 8 miles S Adelaide River, 4.iv.1973 (CANB); *F.Mueller MEL 695461*, Fitzmaurice River, viii.1855 (MEL); *M.Parker 554*, Darwin River, 26.xi.1974 (DNA, NE, NT); *M.Reed 19*, Edith Falls, 20.i.1978 (CANB, DNA); *A.V.Slee & L.A.Craven 2497*, Upper Birdie Creek, 18.iv.1990 (CANB); *H.R.Toelken 9491*, above Edith Falls, 22.v.2004 (AD, DNA, CANB).

45. *Hibbertia lepidota* R.Br. ex DC.

Syst. Nat. 1: 432 (1817); Prodr. 1: 75 (1824); G.Don, Gen. Hist. 1: 76 (1831); Benth., Fl. Austral. 1: 31 (1863); F.Muell., Syst. Cens. 1: 2 (1882); Sec. Syst. Cens. 1: 2 (1889); Gilg, Nat. Pflanzenfam. 3, 6: 117 (1893); F.M.Bailey, Qld Fl. 1: 14 (1899); Compreh. Catal. Qld Pl. 21, fig 5 (1913); Ewart & Davies, Fl. North. Terr. 193 (1917); Gilg & Werderm., Nat. Pflanzenfam. 2 edn, 21: 26 (1925); C.T.White, Proc. Roy. Soc. Queensl. 47: 52 (1936); Specht in Specht & Mountf., Rec. Amer.-Austral. Sci. Exped. Arnhem Land 3, 260, 400, 464 (1958); Chippend., Proc. Linn. Soc. NSW 96: 249 (1972); A.S.George & Kenneally, Wild. Res. Bull. West. Austr. 6: 52 (1977); Harmer, N. Austr. Pl. 1: 46 (1976); Dunlop et al., North. Terr. Bot. Bull. 1. Bot Surv. Elcho Island 20 (1976); N.G.Marchant & Keighery, Kings Park Research Notes 5: 64 (1979); J.R.Wheeler, Fl. Kimberley Reg. 154, fig. 41D (1992); K.Brennan, Checklist Aligators Rivers Reg. 45 (1996); Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007). — **Typus**: Northern Territory, Carpentaria, North Island, *R.Brown s.n.* [J.J.Bennett 4861], 18.xii.1802 (holo.: G-DC; iso.: K 75662a, MEL 666862, MEL 666863a, – see Typification below).

Rossittia scabra Ewart & Davies, Fl. North. Terr. 157, pl. XV (1917); J.H.Willis, Vict. Nat. 59:72 (1942); Paul G.Wilson, Nuytsia 1: 11 (1970). — **Typus**: Northern Territory, "Ranges near Western Creek", *G.F.Hill [Hili] 773*, 16.ii.1912 (holo.: MEL).

Shrubs up to 1 m tall, usually single-stemmed but also multistemmed (cf. variations); branches angular from the centre of the leaf base, densely peltate-scaly. *Vestiture* persistent, usually dense (rarely scattered on upper and less often on lower surfaces of leaves), with larger and smaller usually broad-rimmed peltate, rarely ciliate-peltate scales, sometimes becoming lacerated; *on branches* moderate to dense, with larger and smaller, sometimes not regular peltate scales and often becoming lacerated; *on leaves above* moderate to dense, with larger to much smaller scales not arranged in rows (4–7 (–14 mainly in Queensland) scales across), rarely overtopping margins; *on leaves below* dense to commonly very dense, with larger (sometimes ciliate-peltate scales) over smaller scales, ± overtopping margins; *on bracts* above sparser, below usually very dense, like leaves with larger over smaller scales ± overtopping margins but only at base ± unilaterally enlarged; *on outer calyx* outside densely covered with larger over smaller scales ± overtopping margins but only at base ± unilaterally enlarged (rarely ciliolate-peltate), inside with ± scattered usually ciliate-peltate scales at least on upper half; *inner calyx lobes* outside densely covered with larger

over smaller scales but not overtopping membranous margins nor with cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* usually absent or indistinct; *lamina* linear, linear-elliptic, rarely narrowly elliptic-oblanceolate, (0.7–) 15–25 (–43.2) × 0.5–2.2 mm, acute or with pointed recurved vein-end ± covered with large scales, very gradually constricted into base, entire, usually ± furrowed to boat-shaped with margins ± incurved, above usually moderately to sparsely peltate-scaly, below with central vein not protruding, densely or rarely moderately peltate-scaly, discolourous; juvenile leaves not seen. *Flowers* 1 (2, 3), "axillary", with rudimentary leaves or if 2–5 flowers then usually with ± developed short shoots and then often also with a terminal one on main branches, with buds spherical to pyriform, surrounded by spreading acute apex of bract and usually outer calyx lobes; *peduncle* short to slender, (2.8-) 3.5–8 (–12.6) mm long, ± compressed; *bracts* linear-triangular to lanceolate, 1.1–1.7 × 0.5–0.65 mm, acute and apex ± recurved, above and below densely scaly. *Calyx* with lobes unequal; *outer calyx lobes* (2) oblong-lanceolate to -ovate, 3.5–4.1 × 1.1–1.4 (–1.6) mm, usually distinctly shorter than inner ones, with ± acute apex spreading to recurved, with faint or without central ridge, outside densely peltate-scaly overtopping margins but ± unilaterally enlarged only on the margin, inside ciliate-scaly at least on the upper half; *inner calyx lobes* oblong-obovate, 4.1–5.4 × 2.1–2.6 (–3.1) mm, rounded, without ridge, with membranous margin, outside densely scaly and without cilia, inside glabrous. *Petals* obovate, 4.4–5.8 mm long, distinctly bilobed. *Stamens* 15–24 (without or with up to 6 staminodes), subequal, in several bundles around the ovaries; *filaments* strap-like, rarely filiform, 1.1–1.8 mm long, scarcely connate basally; *anthers* broadly obloid, 0.8–1.1 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* almost spherical, each with 2 basal ovules, densely peltate-scaly, with styles attached to the outside apex then curved up-, out- and inward again well above the anthers. *Fruiting peduncle* strongly recurved to once or twice coiled. *Seeds* obovoid, 2.4–2.6 × 2.4–2.5 mm, black to brown; aril with fleshy attachment and cup-shaped sheath (scarcely lobed) covering the lower third to almost half of seeds. *Flowering*: December–August. **Figs. 12K–O & 17 E**.

Distribution and ecology. Grows on sandy to gravelly soil on or associated with sandstone outcrops or boulder strewn banks of rivers/creeks in eucalypt woodland in north-eastern Western Australia (NK, VB), Northern Territory (VR, A, C) and northern Queensland (Bk, Co).

Conservation status. Locally common and widespread.

Diagnostic features. The whole plant of *H. lepidota* is covered with irregular scales (rarely ciliate-peltate scales) of different sizes. The adaxial surface of the narrow leaves is covered with usually 4–7 or rarely even more scales, in contrast to the segregate species *H. marrawalina*, where three scales are more or less arranged in rows. The scales of *H. lepidota* are of distinctly different sizes and not arranged in rows. Other characteristics of *H. lepidota* are usually rigid woody main stems, as well as the pointed bracts and outer calyx lobes, both of which are usually recurved distally. This clearly distinguishes it from *H. sulcata*, a similar species, but with three rows of mainly large scales on the upper leaf surface.

Plants of *H. brevipedunculata* with linear, more or less scaly leaves have also often been confused with *H. lepidota*. However, the former is distinguished from the latter by its individually raised central vein and more or less recurved leaf margins. If the leaf of *H. brevipedunculata* is occasionally deeply grooved, the margins are spreading and not incurved as in *H. lepidota*, and the larger ellipsoidal buds have the bracts and outer calyx lobes more or less appressed. *H. ciliolata* can be distinguished from all the above mentioned species by its pronounced central vein on leaves, usually two "axillary" flowers per leaf axil (often without short shoots), and very short peduncles.

Variation. *Hibbertia lepidota* is a very variable species largely due to an extreme range between fast growing branches and senescent ones. Several local forms are also found, but they were not given taxonomic rank because distinctive characters could either not be absolutely maintained or were not linked to other characters and/or defined geographically. For instance, narrow leaves (0.9–1.2 mm broad) are a particularly obvious character but they seem to re-occur in three different populations:

1. Plants recorded from the southern end of the western escarpment of the Arnhem Plateau, viz. Gunlon (*H.R.Toelken 9489*) to south of Nitmiluk (*H.S.Mckee 8553*) and westwards to the Macadam Range, (*C.R.Dunlop 8087 & I.D.Cowie*) have usually long thin recurved leaves.

2. Narrow but straight leaves have been recorded from the Gove Peninsula, north-eastern Arhem Land, e.g. *G.M.Wightman 4248*, but in contrast to the two segregate species *H. marrawalina* and *H. sulcata* they have four or more scales across the upper leaf surface and usually spreading pointed bracts and outer calyx lobes.

3. Similarly, recurved narrow leaves have also been recorded from the north-western Kimberleys (*M.Lazarides 8721*), but the leaves are much shorter.

At least some of the scales on *H. lepidota* are ciliate, especially on the undersurface of leaves of plants from Elcho Island (*J.R.Maconochie 2161*), Northern Territory. The collection *G.J.Leach 3073* (AD) from Wigram Island shows a unique range of variation, with one branch having ciliate-peltate vestiture adaxially and ciliolate-peltate abaxially on very broad leaves, and thus resembling *H. ciliolata*. The other branches of the same specimen have scales as typical of *H. lepidota*. However, when seen as a range together with the specimens *K.G.Brennan 3387 & 3401* from the same island this

unusual population of *H. lepidota* seem to present an extreme case of an occasional retention of juvenile fascicled hairs on flowering plants. Many collections from northern Queensland, e.g. *L.J.Brass 1762*, also often have ciliolate-peltate scales on the undersurface.

The flowers on actively growing branches are "axillary" in a series of successive leaf axils, each flower usually on much reduced short shoots, which often increase with each successive flower downwards. Some of these branches maintain a steady growth so that there may be more than one flower per axillary branch and/or fruits become obviously leaf-opposed. In contrast to this there are those specimens (e.g. *Latz 10168*, Sculthorpe Pound), which have only a few scattered flowers; these are invariably terminal and leaf-opposed on the main branches, although their position is sometimes difficult to distinguish among clustered leaves. These branches are usually senescent with reduced growth or from plants growing under less favourable conditions and are therefore often from areas peripheral to the distribution of the species.

The bracts and outer two calyx lobes of *H. lepidota* are usually acute and their apex is more or less recurved. In extreme cases they appear pointed as these apices have more or less incurved margins and/or a terminal bristle. However, occasionally plants with acute but more or less appressed outer calyx lobes have been recorded locally.

Some variation in the number of stamens, and also the number of staminodes has been observed but no correlation between the two, or one of them and other characters could be established.

The habit of *H. lepidota* is usually an erect shrub with one, rarely few erect stems, but in the south-western parts of the Kakadu National Park (*L.G.Adams & M.Lazarides 3109, R.Story CANB 255454*) some specimens with multi-stemmed habit and extremely long leaves have been recorded. Since this area adjoins the distribution of *H. brevipedunculata* along the Adelaide River it is tempting to speculate on hybridization and/or introgression between the two species, especially as similar specimens have also been recorded from the Mitchell Plateau, Western Australia, where again the two species occur in close proximity. However a collection from Adelaide River in the Northern Territory is unusual in that it shows obvious signs of resprouting after previous burning whereas normally this species re-establishes itself from seed. A similar explanation could apply to *P.A.Fryxell et al. 4838* from Casuarina Creek in Western Australia. Another specimen from Western Australia, *A.C.Beauglehole 51681*, King Edward River, has narrowly linear leaves that are only grooved above along the central vein and with spreading margins, as well as an obviously raised central vein, but the ellipsoidal flower buds indicate that it is a form of *H. brevipedunculata*.

The variation of these long leaves is in some specimens visually accentuated by how tightly they are folded lengthwise. While adult leaves of most collections have (3) 4–7 scales across the mid-upper surface, some broader leaves tend have 10–14 scales and are usually less densely clustered in specimens recorded from Nitmiluk National Park, e.g. *L.A.Craven 6702*. Long-leaved plants are easily confused with *H. ciliolata* from the same locality, but this species has usually more than 20 ciliolate scales across the upper leaf surface, longer leaves with pronounced central vein, and the hairs on the upper leaf surface are covered with ciliate- to ciliolate-peltate scales, while in *H. lepidota* the scales of the lower leaf surface are often ciliolate (see also variation of *H. ciliolata*). Similar broader leaves with more scales on the upper leaf surface were also recorded from the Newcastle Range in Queensland (*J.L.Brass 1762*), where this character is usually combined with two axillary flowers being born on short shoots, but insufficient material does not allow interpretation of these local forms.

Typification. The holotype of *H. lepidota* has rigidly erect branches with short erect leaves clustered distally and thus resembles the most common form, which is found throughout the wide range of distribution of the species. However, some type specimens have been observed to consist of two elements, as for instance sheet *R.Brown K 75662* (with blue Bennett label trimmed) containing (a) three branches of a rigidly erect form as above, with an original label "Hibbertia lepidota North Coast [North Island]"; (b) a very delicate, presumably decumbent plant, with usually strongly recurved leaves that are rarely more than 1 mm broad, representing a form commonly recorded from the Gove Peninsula, as the original Brown label with it confirms: "Hibbertia lepidota ?β tenuifolia Bay 3 [Arnhem Bay] North Coast". Two similar elements are found on MEL 666863a & b except that the sheet has only one original Brown label reading "Hibbertia lepidota/ north coast" as well as a later blue Bennett one. The two labels on the specimens at K indicate that Brown collected the species at different localities and that he did not mention this variety under *H. lepidota* in his manuscript, which is based on the collection from North Island. J.J. Bennett's system of numbering, attempting to separate different collections in Brown's Herbarium (Groves 2006), appears to have overlooked this separate variety from Arnhem Bay. It is here not considered part of the type collection, although the Bennett number might suggest so.

Selection of specimens examined (124 seen)

WESTERN AUSTRALIA: *A.C.Beauglehole 52709*, Meda–Oobagooma Road, 12.vi.19 (CANB); *G.W.Carr 3303 & A.C.Beauglehole 47081*, Cockburn Range, ca 13 km W King River, 10.vii.1974 (CANB); *P.A.Fryxell & L.A.Craven 3902*, Creek entering inlet of Talbot Bay, 1.v.1983 (CANB); *P.A.Fryxell & L.A.Craven 4152*, near Drysdale River, 16.v.1983; *P.A.Fryxell, L.A.Craven & J.McD.Stewart 4788*, E shore of Admiralty Gulf, 14.vi.1983 (CANB); *P.A.Fryxell, L.A.Craven & J.McD.Stewart 4838*, 8 km WNW Mount Casuarina, 16.vi.1985 (PERTH); *H.G.Hartley 14828*, headwaters of Helby River, 27.iii.1978 (CANB,

NT); *K.F.Kenneally 4160*, Site B3, Drysdale River National Park, 9.viii.1975 (PERTH); *K.F.Kenneally 4377*, Woorakin Creek, 16.viii.1975 (CANB); *M.Lazarides 8683*, Ashton Range, 23.iii.1978 (CANB, NT); *M.Lazarides 8721*, Carsons Escarpment, near Wonjarring Gorge, 25.iii.1978 (CANB, NT).

NORTHERN TERRITORY: *L.G.Adams & M.Lazarides 3099*, ca 31 km ENE Goodparla Station, 26.ii.1973 (NT); *A.C.Beauglehole 54886*, 60 km E.S.E of Borroloola, 13.vii.1973 (CANB, MEL); *L.A.Craven 3577*, McArthur River, 1.ii.1976 (CANB, NT); *L.A.Craven 3835*, Clarke Bay, Centre Island, 11.ii.1976 (CANB); *L.A.Craven 6308*, Mt Basedow, 3.vi.1980 (DNA, MEL); *L.A.Craven 6702*, Katherine Gorge, 6.iv.1981 (DNA); *C.RDunlop 8087 & G.J.Leach*, Macadam Range, 2.iii.1989 (AD, CANB, DNA); *P.K.Latz 10168*, Sculthorpe Pound, 29.viii.1985 (CANB, NT); *M.Lazarides 7037*, Katherine Gorge, 8.iii.1964 (CANB, NT); *M.Lazarides & Adams 104*, 47 miles NE Maranboy Police, 6.iii.1965 (CANB); *G.J.Leach 2756 & I.D.Cowie*, 14 km E Sleibeck, 18.iv.1990 (AD, CANB); *G.J.Leach 3053* & *G.J.Leach 3073*, Wigram Island, 24.vii.1992 (DNA); *J.R.Maconochie 2161*, Elcho Island, 9.vii.1975 (CANB, DNA, NSW); *H.S.Mckee 8553*, 15 miles Katherine to Wyndham, 8.ii.1961 (NSW); *F.Mueller MEL 119753*, head of McArthur River, 1855 (K, MEL); *F.Mueller 119754*, McAdam Range, x.1855 (K, MEL); *D.E.Murfet 4831*, Nhulunbuy Industry area, 15.xii.2004 (AD, DNA); *J.Must 1547*, 31 km W Borroloola, 27.vi.1977 (CANB, DNA, NSW); *B.L.Rice 2247*, Centre Island, 9.ii.1976 (CANB); *A.V.Slee & L.A.Craven 2651*, 4 km S El Sharana, 20.vi.1990 (AD, CANB); *R.L.Specht 940*, Gove, 22.viii.1948 (CANB, NSW); *H.R.Toelken 9489*, Gunlom Waterfall, 20.v.2004 (AD, CANB, DNA).

QUEENSLAND: *W.E.Armit 757*, Robertson River, s.d. (MEL); *F.M.Bailey NSW 225135*, North Coast, (NSW); *L.J.Brass 297*, Settlement Creek, ii.1923 (BRI, CANB, NSW); *L.J.Brass 1762*, Newcastle Range, ii.1928 (BRI, CANB); *J.R.Clarkson 4262*, Walsh River on Chillagoe road to Wrotham Park, 14.i.1982 (BRI, NT); *P.I.Forster 22590*, 80 km NW Mt Surprise, 24.iv.1998 (AD); *B.Hyland 8095*, Gugu Yalungi Main Camp, 8.iii.1975 (QRS); *M.B.Thomas 284*, Split Rock Gallery, ca 20 km S Laura, 6.vii.1988 (BRI).

46. *Hibbertia marrawalina* Toelken, *sp. nov.*

Hibbertiae lepidotae *similis sed habitu multicaule, foliis gracilibus paginis adaxialibus sulcatis seriebus duobus squamarum et bracteis lobisque calicis exteris obtusis et adpressis differt.*

Typus: Northern Territory, Nitmiluk National Park, Marrawal Plateau North, *C.R.Michell 4190*, 16.iv.2002 (holo.: DNA).

Shrublets to 0.3 m tall, densely multistemmed from a scaly underground rootstock; branches wiry, scarcely angled from centre of leafbase, densely scaly. *Vestiture* persistent, ± dense, with circular or irregular, larger and smaller mainly broad-rimmed peltate scales on all parts of the plants; *on branches* densely scaly with few larger, rarely ciliolate-peltate scales over smaller ones; *on leaves above* ± dense, with subequal scales usually in one row on either incurved side but rarely overtopping margins; *on leaves below* dense, with larger over smaller peltate scales also covering terminal vein-end (without cilia) and distinctly overtopping margins; *on bracts* above and below densely scaly, with lower ones overtopping margins (without cilia); *on outer calyx lobes* outside densely scaly with scarcely larger over smaller ones usually overtopping margins some of which are unilaterally enlarged especially towards the apex, inside ciliate-scaly on upper half; *on inner calyx lobes* outside densely peltate-scaly and membranous margin without cilia; inside glabrous. *Leaves* without axillary tufts of hairs; *petiole* absent or indistinct; *lamina* narrowly linear, (5.8–) 30–45 (–56.6) × 0.6–0.8 mm, drawn into a scarcely recurved vein-end up to 1.3 mm long and densely scaly, not or scarcely constricted and with incurved margins towards the base, entire, shallowly furrowed and above densely scaly with mainly two rows of large scales, below convex without central vein visible and densely scaly with margins of scales often overtopping margins, faintly discolourous; juvenile leaves (coppicing) with slightly more ciliate scales. *Flowers* 1, "axillary", with or without rudimentary leaves, towards the apex of main branches, usually at two successive nodes, with buds ± spherical; *peduncle* stiff, 5.3–10.6 mm long, slightly compressed; *bracts* linear to linear-triangular, 0.9–1.2 × 0.5–0.6 mm, much shorter than outer calyx lobes, obtuse, fleshy, appressed, above and below ± densely scaly. *Calyx* with lobes unequal, *outer calyx lobes* (2) oblong rarely oblong-obovate, 3.1–3.5 × 1.4–1.75 mm, usually more than half as long as inner ones, rounded with appressed or incurved apex, without central ridge, outside densely scaly with scales overtopping margins, inside usually ciliate-scaly on upper half; *inner calyx lobes* obovate, 3.6–4.1 × 2.1–2.3 mm, rounded and with membranous margins without cilia, outside densely scaly, inside glabrous. *Petals* cuneate-obovate, 4.6–5.9 mm, bilobed. *Stamens* 15–18 (with 6–8 staminodes), subequal, in bundles around ovaries; *filaments* filiform to strap-like, 0.5–0.8 mm long, scarcely connate basally; *anthers* broadly obloid, 0.8–1.1 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with styles attached to the outer apex and from there curved out-, up-, and inward to place the constricted stigma above the anthers. *Fruiting peduncles* somewhat elongating, recurved. *Seeds* not seen. *Flowering*: April. **Fig. 17F, G**.

Distribution and ecology. "Locally common on sandy plateau surface in tall open woodland with *Eucalyptus tetrodonta* and *E. miniata* over perennial *Sorghum*" (*C.R.Michell 4190*) on the Marrawal Plateau in the Northern Territory (A).

Diagnostic features. This species has incurved leaves as in *H. lepidota*, but is distinguished by its multistemmed habit and its slender leaves with usually only two rows of scales on the upper surface. The leaf terminates in a mucro up to 1.3 mm long, and the apex of the bracts and the outer calyx lobes are obtuse and more or less appressed.

Variation. The marked difference in the length of leaves and internodes between young and senescent branches,

as commonly observed in hibbertias, was not recorded in this species. Most of the leaves were of similar size and relatively long, and only occasionally short shoots with much shorter leaves were observed in some of the lower leaf axils.

The upper surface of the leaves is usually covered with 2 rows of scales, but occasionally there is a third row in the lower third of some leaves.

Etymology. Hibbertia marrawalina has only been recorded from the Marrawal Plateau and therefore the suffix "–ina", Latin, "belongs", was added to the locality name.

Specimens examined

NORTHERN TERRITORY: *C.R.Michell 4189*, 9.iv.2002 (DNA) & *C.R.Michell 4191*, 3.v.2002 (DNA), Marrawal Plateau.

47. *Hibbertia sulcata* Toelken, *sp. nov.*

Hibbertiae lepidotae *similis sed caulibus prostratis vel anfractuosis filo metallico similis, foliis gracilibus paginis adaxialibus sulcatis seriebus tribus squamarum et bracteis lobisque calicis externis plus minusque obtusis et adpressis;* H. marrawalinae *persimilis sed caulibus prostratis, foliorum paginis adaxialibus sulcatis seriebus tribus squamarum et acuminibus terminalibus foliorum parvis et pilis simplicibus; a* H. pholidota *foliis sulcatis et usque 2 mm latis differt.*

Typus: Northern Territory, Gumadir region, N Gudjekbinj outstation, *K.G.Brennan 5750*, 30.viii.2002 (holo.: DNA).

Shrublet to 0.2 m tall, presumed multi-stemmed, with sprawling intertwining often flexuous wiry branches producing short shoots with fascicled leaves; branches ± ridged from the centre of the leaf base, moderately scaly. *Vestiture* persistent, with ± dense often irregularly shaped or ciliolate-peltate, mainly broad-rimmed membranous scales on all part of the plants; *on branches* moderately dense to sparse, with few slightly larger ones together with a range of smaller scales of often irregular shapes; *on leaves above* moderate to sparse, with mainly larger and interspersed few smaller scales ± arranged in three rows; *on leaves below* dense to very dense, with larger over smaller scales ± overtopping margins; *on bracts* like leaves above sparse and below more dense, with larger over smaller scales often overtopping margins with slightly unilaterally enlarged scales especially distally and usually distinctly ciliate terminally; *on outer calyx* outside dense, with few larger over smaller scales to smaller, often irregularly enlarged ones overtopping the margins, inside with ± scattered usually ciliate-peltate scales; *inner calyx lobes* outside densely covered with few larger centrally to smaller scales but not overtopping scarcely membranous margins, without cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* absent or indistinguishable, with base grooved; *lamina* linear, (13.2–) 20–35 (–41.1) × (0.9–) 1.2–1.6 (–2.15) mm, acute or cuspidate with recurved vein-end covered with scales to unilaterally enlarged to unilaterally enlarged ciliate-scales to one or few terminal simple hairs, very gradually tapering into base, entire, above incurved and grooved to furrowed usually with 3 rows of mainly large scales along margins and central vein, below with central vein obscured by dense scales overtopping the margins, straight, discolourous; juvenile leaves not seen. *Flowers* 1 or 2, "axillary" on short shoots with or without subtending leaves, scattered on main branches, with buds spherical to pyriform; *peduncle* stiffly wiry, 3.3–5.7 mm long, almost terete; *bracts* linear, rarely linear-lanceolate, 1.1–1.25 × 0.5–0.6 mm, acute and each with terminal hair(s), above scattered scales, below densely scaly overtopping the margins. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate, 1.9–2.4 × 1.7–2.2 mm, about half as long as inner ones, obtuse to rounded but sometimes with terminal hair, without ridge, outside densely scaly often overtopping margins, inside sparsely ciliate-scaly on upper half; *inner calyx lobes* (3) oblong-obovate, 4.1–4.5 × 3.05–3.2 mm, rounded with membranous margin scarcely protruding beyond scales, without ridge, outside densely scaly and without cilia, inside glabrous. *Petals* usually cuneate-obovate, 4.2–5.6 mm, broadly bilobed. *Stamens* 22–24 (without staminodes), subequal, in groups around ovaries; *filaments* strap-like, 0.7–0.9 mm long, scarcely connate basally; *anthers* obloid, 0.85–1.0 mm long, abruptly constricted above and below with ± cuspidate apex. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, densely scaly, with style attached to the outer apex from where it is curved out-, up- and again inwards to place the constricted stigmas between the upper part of the anthers. *Fruiting peduncle* scarcely elongating, recurved. *Seeds* obovoid to almost spherical, 2.2 × 2.3 mm, dark brown, aril with fleshy base then enlarging into a short sheath (scarcely lobed) covering about the lower third of the seed. *Flowering*: August. **Fig. 17H, I**.

Distribution and ecology. Known only from the type specimen, which was collected in north-eastern Arnhem Land (A), and is without ecological data.

Conservation status. Unknown.

Diagnostic features. Hibberta sulcata resembles *H. marrawalina*, because it has similar linear furrowed leaves, sometimes folded lengthwise and with few large scales, but the outer calyx lobes of *H. marrawalina* are usually distinctly shorter than the inner ones and the bract is more or less pointed with terminal simple hair(s). The leaves, although incurved to folded lengthwise and covered with large scales, do not resemble those of *H. incurvata* since they are linear. In addition, the rounded flower buds have appressed rounded apices of the bracts and/or at least the outer calyx lobes. These flower characters also distinguish *H. sulcata* from *H. lepidota*, which under adverse conditions, such as in currents of seasonal streams on river banks, change its erect habit to become sprawling (*Toelken 9489*). The wiry flexuous branches and basal short shoots of *H. sulcata* are superficially similar to *H. fractiflexa* subsp. *filicaulis*,

which has similar rounded bracts and calyx lobes. However, *H. sulcata* has large membranous scales on the leaves (usually only 3 across on the mid-upper surface), the central vein is not raised at all and the leaves are commonly incurved and folded lengthwise.

Variation. The upper surface of leaves of *H. sulcata* is, similar to *H. marrawalina*, normally covered with three more or less regular rows of scales. One is found along each of the incurved margins, and an additional row on the central vein. These three rows are very regular, except for the occasional smaller two scales next to one another. On broader leaves the outer rows of scales retain their position close to the margins, so that a sizeable gap develops between the outer two rows and the central one. A similar development of mainly similar large scales and a gap between them resembles the arrangement on the upper surface of leaves of *H. pholidota*, except that the leaves of this species are broader and usually flat. The wiry branches and the development of short shoots, often along the base of the branches, are characteristic of both these species.

Etymology. The species epithet "sulcata", Latin, "furrowed", refers to the regularly incurved margins of the leaves.

Specimens examined.

Known only from the type specimen.

48. *Hibbertia pholidota* S.T.Reynolds

Austrobaileya 3(3): 538 (1991); Jessup in Bostock & A.E.Holland, Cens. Queensland Fl. 64 (2007). — **Type**: Queensland, Hinchinbrook Island, Deluge Inlet, north branch 3.5 km from mouth, *A. & M.Thorseborne 520*, 7 June 1977 (holo.: BRI).

Shrubs rarely up to 2 m high, spreading to scrambling; branches long and little-branched or covered with short shoots towards the base, ridged to winged from the middle of the leaf base, usually densely scaly. *Vestiture* persistent, with larger and smaller broad-rimmed ciliolate-peltate and/or entire scales on branches, leaves and calyx; *on branches* very dense, with larger over smaller broad-rimmed, often ciliolate-peltate scales often fraying but rarely wearing off completely; *on leaves above* sparse and scattered becoming localised, with subequal broad-rimmed peltate scales (usually not ciliolate) in a single row along each margin and often also a row above the central vein, wearing off readily; *on leaves below* very dense, with larger over smaller broad-rimmed often ciliolate-peltate scales ± overtopping the margins; *on bracts* above sparse, below dense, with few larger over smaller ciliolate-peltate scales; *on outer calyx lobes* outside dense to very dense, with larger over smaller broad-rimmed peltate scales and some slightly unilaterally enlarged ones overtopping margins, inside with scattered ciliate-peltate scales on upper half; *on inner calyx lobes* outside very dense, with larger over smaller broad-rimmed peltate scales and without cilia on membranous margins, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0.9–2.4 mm long, indistinct, deeply grooved; *lamina* oblong-elliptic, (8.2–) 15–30 (–40.2) × (4–) 6–10 (–13.1) mm, truncate to slightly emarginate and with short vein-end covered with overtopping scales, gradually to almost abruptly constricted into petiole, entire, ± flat, above slightly grooved along the central vein and sparsely scaly becoming reduced to one marginal row or rarely glabrous, below with margins flat or slightly recurved and raised central vein, densely scaly often overtopping margins, distinctly discolourous; juvenile leaves not seen. *Flowers* 1, terminal and with several leaves between successive ones on short shoots becoming shorter to almost absent and "axillary" below the apex of main branch, with spherical buds; *peduncle* thread-like, (5.5–) 12–25 (–35.4) mm long, somewhat compressed particularly below flower; *bracts* linear, linear-lanceolate, 2.1–2.8 × 0.8–1.3 mm, shorter than outer calyx, bluntly acute with apex appressed, ridged in upper part, above sparsely ciliolate-scaly, below densely ciliolate-scaly and overtopping margins. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate-oblong, 4.4–5.2 × 2.2–2.6 mm, about two-third as long as inner ones, obtuse, with apex appressed or slightly spreading, scarcely ridged, outside densely scaly with some ± unilaterally enlarged along and ± overtopping margins, inside sparsely ciliolate-scaly on the upper half; *inner calyx lobes* (3) oblong-obovate, 5.2–5.8 × 3.5–4.3 mm, rounded and without ridge, with membranous margin without cilia, outside densely scaly, inside glabrous. *Petals* cuneate-obovate, 5.3–7.6 mm long, distinctly bilobed. *Stamens* 30–36 (without staminodes), subequal, arranged around ovaries; *filaments* narrowly strap-like, 1.2–1.4 mm long, scarcely basally connate; *anthers* narrowly obloid, 1.2–1.5 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* broadly obovoid, each with 2 basal ovules, densely scaly, with style attached to apex from where it is curved out-, up-, and again inwards to place the constricted stigmas just above the apex of the anthers. *Fruiting peduncle* well elongated, recurved. *Seeds* not seen; quote from type description: "Seeds solitary in each carpel, subglobose, to 2 × 3 mm, reddish brown, with a small membranous campanulate lobed aril at its base". *Flowering*: November, January. **Fig. 17J, K**.

Distribution and ecology. Grows in sandy soil often associated with rock outcrops usually along creeks in a restricted part of the coast and adjoining Hinchinbrook Island in northern Queensland (Nk).

Conservation status. Unknown.

Diagnostic features. Hibbertia pholidota resembles *H. fractiflexa* (Northern Territory), which has a similar scrambling habit with short shoots towards the base. *H. pholidota* can be distinguished by its larger coarse scales, which are scattered on young leaves; on older leaves the scales are more or less retained in a single row along each margin and often another row above the

central vein on the upper leaf surface. *H. pholidota* was included in the *H. lepidota* subgroup, because the large scales commonly overtop the margins of the petioles and the terminal vein-end on the undersurface, which is an important characteristic of this subgroup. This is the only Queensland endemic in the *H. lepidota* subgroup.

This species is also somewhat similar to *H. incurvata*, except that the latter is a local endemic to Arnhem Land, has a prostrate habit with short woody branches and is much branched, as well as having mainly ciliate-peltate scales.

Variation. The leaves of the long shoots are much larger than those of the short shoots, which usually only develop towards the base of the plant or on older branches.

Notes. The species was collected for the first time by J.Dallachy (MEL 109748−52) in 1867 when he commented: "Hinchinbrook Island 8 November 1867 this is a creeping Hibbertia…".

Specimens examined

QUEENSLAND: *J.Dallachy MEL 1009748-52*, Hinchinbrook Island, 8.ix.1867 (MEL);

49. *Hibbertia brennanii* Toelken, *sp. nov.*

Hibbertiae incurvatae *similis sed 10−12 staminibus pilisque fasciculatis in paginis adaxillaribus foliorum; habitus gracilis; a* H. tricorni *sed plantis squamatis praeter paginae adaxillares foliorum et 10−12 staminibus differt.*

Typus: Northern Territory, Fireplot 139, Kakadu National Park, *K.G.Brennan 3779*, 22.iii.1999 (holo.: DNA).

Hibbertia sp. stellate above (*J.L.Egan 4812*); R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrublets up to 0.3 m high, low spreading; branches wiry becoming stiffly woody, angular from the centre of the leaf base and somewhat flanged, ciliate- to ciliolate-scaly. *Vestiture* persistent, with ciliate to entire mainly broad-rimmed scales on all parts except for appressed rosette-like broad-based fascicled hairs on the upper leaf surface; *on branches* ± dense, with larger and smaller ciliate to almost entire scales; *on leaves above* very dense, subequal, with large reflexed rosette-like broad-based fascicled hairs (12–18 subequal to usually unequal arms) with very few smaller ones in between; *on leaves below* very dense and often in several layers of larger over smaller ciliate-peltate scales often overtopping the margins; *on bracts* above sparse, antrorse rosette-like ± broad-based fascicled hairs with few short arms, below dense to very dense, with ciliate to entire scales, sometimes overtopped by larger ones mainly on the central ridge, and becoming spreading rosette-like broad-based fascicled hairs towards the apex and margins usually with prominent unilaterally enlarged cilia mainly towards the base; *on outer calyx lobes* outside dense to very dense, with ciliate to entire narrow-rimmed scales, sometimes overtopped by larger ones mainly on the central ridge, and becoming spreading rosette-like broad-based fascicled hairs with mainly unilaterally enlarged cilia along the margins, inside few antrorse rosette-like ± broad-based fascicled hairs with few short arms on the upper third; *on inner calyx lobes* dense, with usually entire narrow-rimmed scales that enlarge unilaterally to form fascicled cilia on the outermost lobe but usually with membranous margin and no cilia on the inner two, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0–0.6 mm long, indistinct; *lamina* elliptic to elliptic-oblanceolate, (2.3–) 3–9 (–11.8) × (0.8–) 1.5–4.5 (–6.3) mm, acute to pointed vein-end with tufted unilaterally extended cilia, gradually to almost abruptly constricted into petiole, entire, shallowly cymbiform, above distinctly grooved to ± folded along the central vein, densely appressed-pubescent, below with ± raised central vein, very densely ciliate-scaly, discolourous; juvenile leaves not seen. *Flowers* 1, terminal becoming leaf-opposed and/or "axillary" on short shoots but rarely at successive nodes, with buds spherical; *peduncle* stiffly thread-like, 3.4–6.6 mm long, ± terete; *bracts* linear-elliptic to -triangular, 1.6–2.0 (–2.4) × 0.4–0.65 mm, usually less than half the length of the outer calyx lobes, acute and hardly spreading, scarcely ridged but with distal margins ± incurved, outside very densely scaly, rarely overtopped by few larger ciliate scales and with marginal unilaterally enlarged cilia, inside puberulous to distally pubescent. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate to elliptic, 2.8–3.5 (–3.9) × 1.8–2.1 mm, shorter than or as long as inner ones, acute to acuminate when margins ± incurved, erect, ridged along the whole length, outside very densely scaly overtopped usually by a few ciliate scales along the central ridge especially towards the apex and with unilaterally enlarged cilia along the margins, inside puberulous on upper third; *inner calyx lobes* (3) oblong-obovate to broadly obovate, (2.7–) 3.2–3.7 (–4.2) × 2.4–2.7 (–3.1) mm, obtuse to rounded, scarcely ridged; outside densely scaly and with long marginal cilia on the outer lobe but with pale membranous margin and usually without cilia at least on the innermost two, inside glabrous. *Petals* cuneate-obovate, 3.6–4.2 mm long, distinctly bilobed, pale yellow. *Stamens* 10–12 (without staminodes), subequal, in bundles around the ovaries; *filaments* thread-like, 0.6–0.75 mm long; scarcely connate basally; *anthers* obloid, 0.9–1.1 mm long, abruptly constricted above and below. *Pistils* 2; *ovaries* obovoid, each with 2 basal ovules, ± densely scaly, with style attached to apex then gently curved out-, up- and again inwards to place the constrictedstigmas just above the anthers. *Fruiting peduncle* scarcely elongating, recurved. *Seeds* broadly obovoid, 2.4–2.5 × 2.35–2.4 mm, brown to black; aril with fleshy attachment expanding into a cup-shaped membrane (scarcely lobed) covering the lower third of the seed. *Flowering*: March–May. **Fig. 18A−C**.

Distribution and ecology. Grows in rock crevices in dissected sandstone in heath on top of the escarpment of the Arnhem Plateau, Northern Territory (A).

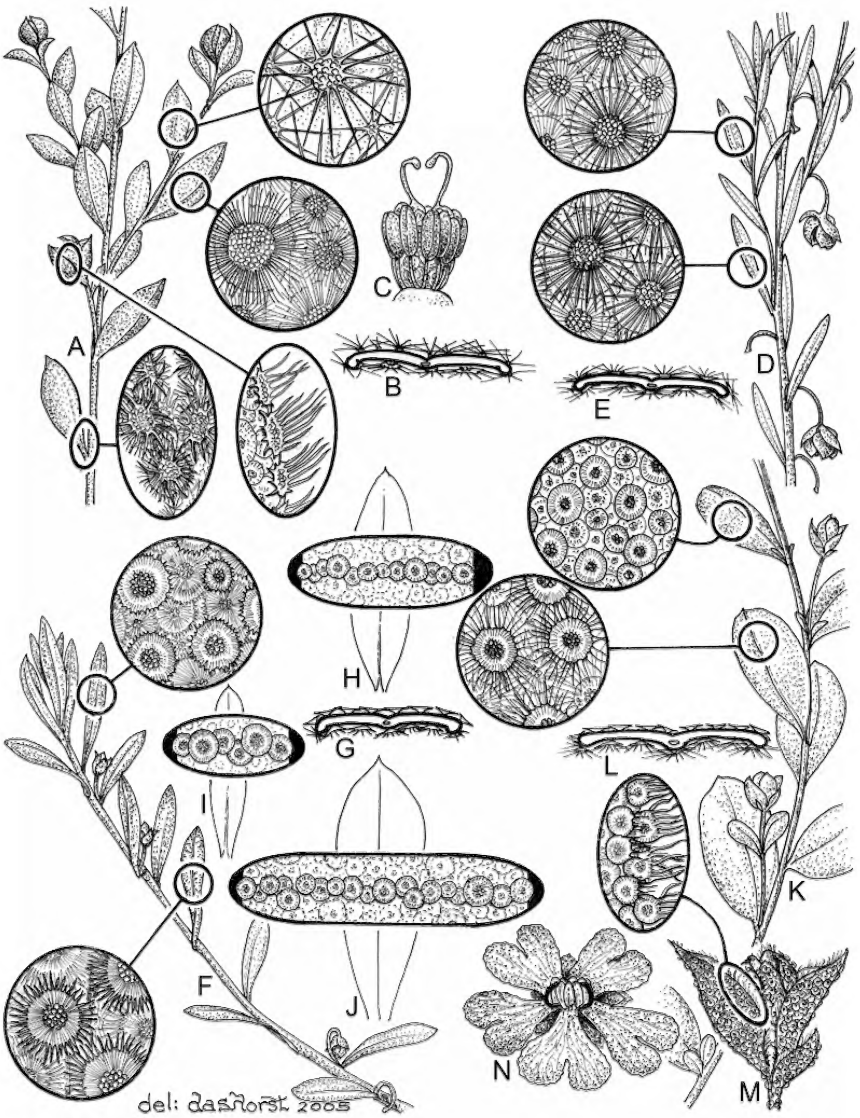


Fig. 18. A–C *H. brennanii*: **A** flowering branch ×1; **B** transverse section through mid-leaf ×5; **C** flower with calyx and corolla removed ×5. **D–E *H. incurvata***: **D** fruiting branch ×1; **E** transverse section through mid-leaf ×10. **F–J *H. argyrochiton***: **F** flowering branch ×1; **G** transverse section through mid-leaf ×5; **H–J** variation on size and number of scales on the upper surface of leaves ×2. **K–N *H. pancerea***: **K** flowering branch ×1; **L** transverse section through mid-leaf ×2; **M** flower bud ×5; **N** open flower ×3. — **A–C** *K.G.Brennan 3779*; **D**, **E** *K.G.Brennan 3297*; **F–J** *D.L.Jones 1487*; **K–N** *K.G.Brennan 3821*.

Conservation status. The species is conserved as it grows in a secluded area in Kakadu National Park. However, as it is recorded as only "occasionally" in an extremely localised area, *H. brennanii* is vulnerable.

Diagnostic features. Although this species shows a close affinity to *H. incurvata*, it is distinguished from the latter by only 10–12 stamens, pronounced marginal cilia, and most importantly by the coarse rosette-like broad-based fascicled hairs on the upper surface of the leaves. Its delicate habit is superficially similar to *H. tricornis*. However, unlike this species, *H. brennanii* has bracts much shorter than the outer calyx lobes, and not only the scales on the undersurface of the leaves but even the fascicled hairs above are more or less appressed.

Variation. The three specimens recorded of this species show remarkably little variation other than small differences in size.

Etymology. The species is named in honour of Kym G. Brennan, who spent much time re-examining, defining, collecting and photographing the hibbertias of the Northern Territory. His knowledge of the species and his keen eye for the unusual or undescribed taxa is well demonstrated by this inobtrusive species, which is known from only a few specimens. This is also in grateful appreciation for his assistance in securing plants of a great number of species for examination and collecting during a short joint field trip in Kakadu National Park.

Specimens examined

NORTHERN TERRITORY: *J.L.Egan 4812 & S.Knox*, ca 10 km NNE Jabiru, 26.iv.1995 (DNA); *R.A.Kerrigan 674*, NE Jabiru, Hollow Rock, 12.v.2003 (DNA).

50. *Hibbertia argyrochiton* Toelken, *sp. nov.*

Hibbertiae incurvatae *similis sed habitu prostrato vix lignoso paginisque adaxialibus foliorum squamis integris; a* H. pancerea *habitu prostrato vix lignoso floribusque precipue antheris minoribus; a* H. fractiflexa *apicibus extrosus recurvis calicis externi tomentosoque squamis ciliatis vel irregulariter laceratis differt.*

Typus: Northern Territory, on Arnhem Sandstone Plateau, *L.A.Craven 2419*, 27.ii.1973 (holo.: CANB 270795; iso.: CANB 270796, NT; A, BRI, L – *n.v.*).

Hibbertia sp. low lepidote (L.A.Craven 6594): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrub up to 0.4 m tall, with prostrate to spreading main branches up to 1 m long; branches often strongly ridged downwards from the centre of the leaf base, with leaves ± widely spaced, rarely on fascicled short shoots at the base, very densely scaly or ciliate-scaly. *Vestiture* persistent, dense to very dense with mainly broad-rimmed scales, larger and usually ciliate-peltate scales over smaller entire ones on the whole plant, but often becoming progressively lacerated; *on branches* dense to very dense with larger usually ciliate-peltate over entire scales, but all soon becoming ± lacerated; *on leaves above* dense with larger and smaller entire peltate scales; *on leaves below* very dense with larger ciliate-peltate scales overtopping usually ± entire ones but all often becoming lacerated and with ciliate to lacerated scales overtopping the margins (rarely unilaterally enlarged); *on bracts* above and below dense, similar to leaves except scales overtopping margins of the undersurface usually ± entire and unilaterally enlarged; *on outer calyx lobes* outside very dense with entire scales even unilaterally enlarged marginal ones or larger ciliate- or lacerate-peltate scales also overtopping the margins over smaller entire ones, inside glabrous or rarely with few ciliate scales at the apex; *on inner calyx lobes* outside very dense with mainly entire scales or rarely overtopped by few ciliate ones and becoming smaller towards the glabrous membranous margins without cilia, inside glabrous. *Leaves* without axillary tuft of hairs; *petiole* 0–1.5 (–3.2) mm long, often indistinct; *lamina* elliptic to elliptic-oblanceolate or-lanceolate, rarely broadly elliptic, (7.8–) 8.5–20 (–52.3) × (3.8–) 4.5–8.0 (–11.4) mm, acute and often pointed vein-end with accentuated terminal tuft of hair/s, gradually tapering into petiole, flat to slightly boat-shaped or rarely folded lengthwise, entire, above scarcely grooved along the central vein and densely scaly, below with margins flat to ± incurved, very densely ± ciliate-scaly with scattered ciliate to lacerated scales on the margins, slightly discolourous; juvenile leaves not seen. *Flowers* 1, or if 2 then on axillary short shoots with leaves, "axillary", below the apex of all branches, with buds spherical except for recurved apices of outer calyx lobes; *peduncle* strap-like, (4.8–) 6–9 (–12.6) mm long, angular to flattened; *bracts* triangular-lanceolate to linear-lanceolate, (1.1–) 1.5–3 (–3.3) × (0.4–) 0.6–0.9 (–1.1) mm, pointed and usually 1 to few terminal bristles, with apex spreading, above and below densely scaly rarely overtopped by scattered ciliate-peltate scales but also usually entire unilaterally enlarged marginals. *Calyx* with *lobes* unequal; *outer calyx lobes* (2) elliptic-lanceolate to -ovate, (3.2–) 3.5–4.1 (–4.7) × (1.7–) 1.9–2.3 (–2.45) mm, shorter to longer then inner ones, acute to pointed and usually with terminal simple bristle/s, margins ± incurved but without ridge on upper half, with apex spreading to scarcely recurved, densely scaly, often with scattered ciliate-peltate scales outside, inside glabrous rarely sparsely smaller ciliate-peltate scaly at the apex; *inner calyx lobes* (3) broadly oblong-obovate to orbicular, (2.9–) 3.2–3.5 (–3.8) × 1.7–2.4 (–2.7) mm, rounded with membranous margins without cilia, outside densely scaly, inside glabrous. *Petals* cuneate-obovate, rarely broadly obovate, 4–5.6 mm long, usually deeply lobed. *Stamens* 20–24 (with 1-5 staminodes mainly dorsally), subequal, in up to 5 groups around the ovaries; *filaments* thread-like, 1–1.2 mm long, scarcely connate basally; *anthers* obloid, 0.9–1.2 mm long, abruptly constricted above and below, straight or scarcely incurved. *Pistils* 2; ovaries broadlyovoid, each with 2 basal ovules, densely peltate, with slender style attached dorso-laterally then style erect and curved forward to place constricted stigma just above the apex of anthers. *Fruiting peduncle* elongating, usually strongly recurved. *Seeds* obovoid to almost spherical, 2.1–2.3 × 2.0–2.1 mm, black, shiny; aril with fleshy attachment expanding into a membranous cup-shaped sheath (slightly sinuate) covering the lower quarter of the seeds. *Flowering*: Mainly February–June. **Figs. 1M & 18F–J**.

Diagnostic features. The very dense peltate scales on most of the plant are reminiscent of those of *H. lepidota*, but *H. argyrochiton* is distinguished by having leaves broader than 3 mm and a decumbent habit. *H. fractiflexa* displays a similar habit, but differs by dense large scales on the lower surface of the petiole and the leaf apex, which overtopping the margins. Often, the membranous scales of *H. argyrochiton* are ciliolate, lacerated or frayed and might resemble, at least in herbarium specimens, scales of forms of *H. brevipedunculata*, but that species is distinguished by their multistemmed erect habit and larger ellipsoidal flower buds.

Distribution and ecology. Growing on shallow sand in rock crevices on top of rocks in eucalyptus woodland of the western escarpment and/or on Arnhem Land sandstone plateau, Northern Territory (A).

Conservation status. Locally frequent in Kakadu National Park.

Variation. The leaf shape varies considerably and in some specimens (near East Alligator River, *I.D.Cowie 8301*; Mt Brockman, *I.R.Telford 8060 & J.W.Wrigley*) they are linear-elliptic, and in these specimens the lower branches are often fascicled short shoots, while normally leaves are well spaced on the whole plant. The leaves on the collection *I.D.Cowie & D.J.Liddle 10295* are broadly elliptic with a more or less rounded leaf apex, except for a short vein-end covered with scales; the leaves are therefore more reminiscent of *H. pancerea*, but that species is distinguished by its shrubby habit, larger flowers and especially longer anthers and styles. The short styles are erect and the delicate stigmas of *H. argyrochiton* are presented just above the apex of the anthers. Cowie and Liddle comment that the flowers open late in the afternoon, which presumably relates to its specialised pollination syndrome.

The scales on branches and on the abaxial leaf surface of the specimen of *T.S.Henshall 1864* are strongly ciliate or lacerated, but those on the adaxial surface are always entire.

Sometimes upper leaves of plants are apically rounded, but usually some with typical acute apices (vein-ends) are found on the same plant (*L.A.Craven 2419*). Obtuse leaves were observed on the specimen *G.M.Wightman 1713 & C.R.Dunlop*, but the branches are typically prostrate and little-branched.

The species has a single "axillary" flower per node, only very rarely two flowers have been recorded. In the specimen *L.A.Craven 2258* all nodes bear 2 or 3 flowers, but in all cases they are borne on a visible short shoot with reduced leaves.

Etymology. The whole plant is densely covered with often overlapping scales so that it appears to be covered by a coat of armour of shiny scales. The epithet "argyrochiton", Greek, "a silvery coat of armour" (noun in apposition), seemed therefore appropriate.

Specimens examined

NORTHERN TERRITORY: *L.Barnett & Azzopardi 17*, Mt Brockman, 22.ii.1977 (CANB, DNA); *K.G.Brennan 3795*, Fire Plot 123, 22.iii.1999 (DNA); *I.D.Cowie 5646 & K.G.Brennan*, upper catchment of Magela Creek, 12.iv.1995 (DNA); *I.D.Cowie 8258 & J.J.Bruhl*, Mt Brockman outlier, 16.iii.1999 (CANB, DNA); *I.D.Cowie 8301 & J.J.Bruhl*, near East Alligator River, W of rock holes, 20.iv.1999 (CANB); *L.A.Craven 2258*, sandstone outcrop, 15.ii.1973 (BRI, CANB, NT); *L.A.Craven 6594* (66) sandy flats, 23.iii.1981 (CANB 2×, MEL); *T.S.Henshall 1864*, Mt Gilruth area, 5.vi.1978 (CANB, NSW, NT); *D.L.Jones 1487*, Lightning Dreaming, 24.ii.1984 (CANB, DNA); *P.Martensz & R.Schodde AE711*, 1 mile N Red Lily Lagoon, 3.ii.1973 (NSW); *A.V.Slee & L.A.Craven 3054*, 0.7 km upstream from UDP Falls, 30.iv.1990 (AD); *I.R.Telford 8060 & J.W.Wrigley*, 6 km SW Mt Brockman, 23.iv.1980 (AD, CANB, DNA); *G.M.Wightman 1713 & C.R.Dunlop*, Magela Creek headwater, 12.ix.1984 (CANB, DNA, MEL).

51. *Hibbertia incurvata* Toelken, *sp. nov.*

Hibbertiae lepidotae *similis sed foliis ellipticolanceolatis marginibus asymetrice incurvatis; a* H. argyrochiton *habitu erecto lignoso, foliis incurvatis paginisque adaxialibus foliorum aliquot squamis ciliatis differt.*

Typus: Northern Territory, ca 56 km S Maningrida, *I.D.Cowie 8532*, 16.iii.2000 (holo.: DNA).

Hibbertia sp. rock platforms (*K.G.Brennan 3112*): R.Kerrigan & Albr., Checklist N.T. Vasc. Pl. Sp. 2007.

Shrubs up to 1.5 m tall, spreading; branches stiffly woody, usually ± winged from the centre of the leaf base, densely ciliate-scaly. *Vestiture* persistent, very dense, with larger over smaller mainly broad-rimmed ciliate-peltate and/or entire peltate scales (rarely rosette-like broad-base fascicled hairs on branches and leaves) and ± fascicled-ciliate on leaves, bracts and calyx; *on branches* dense, with larger and/or usually distinctly ciliate-peltate scales over smaller and often less markedly ciliate-peltate scales; *on leaves above* dense, with larger rarely ciliolate-peltate scales (especially towards the margins) over smaller entire scales, with ciliolate-peltate scales overtopping the margins and terminal tuft of simple hairs often surrounded by scales; *on leaves below* very dense, with scattered larger and normally distinctly ciliate-peltate scales overlapping smaller ± distinctly ciliolate-peltate scales, with some overtopping margins; *on bracts* above and below similar to leaves, dense with larger over smaller ciliolate-peltate scales some of which overtop the margins; *on outer* and *inner calyx* outside very dense, with larger over smaller ± ciliolate unilaterally enlarged scales near the margins and without cilia but often overtopping lower margins, inside with ciliate-peltate scales on upper half of outer calyx lobes, glabrous on inner calyx lobes. *Leaves* without axillary tuft of hairs; *petiole* 0–1.6 mm long, indistinct; *lamina* elliptic-oblanceolate, rarely lanceolate-elliptic to narrowly elliptic, (3.3–) 5.5–12 (–22.1) × (0.9–) 2.5–4 (–4.8) mm, pointed vein-end with tuft of hairs, gradually constricted into petiole, entire, above ± boat-shaped with incurved margins and densely scaly, below with central vein not or scarcely visible and very densely scaly, scarcely discolourous; juvenile leaves not seen. *Flowers* single, terminal becoming leaf-opposed and with several leaves between successive ones, or "axillary" with 1 or 2 flowers on short shoots but rarely some become much shorter, usually below the apex of main branch, with spherical buds; *peduncle* stiff, (3.2–) 5–9 (–10.8) mm long, somewhat compressed; *bracts* lanceolate, rarely ovate, 2.8–4.6 × 1.2–1.7 mm, just shorter to about half as long as outer calyx, acute with apex spreading, with ridge visible on lower half, densely ciliolate-scaly on both sides and with scales (some unilaterally enlarged) overtopping margins

mainly below. *Calyx* with lobes unequal; *outer calyx lobes* (2) lanceolate, rarely ovate, 4.2–5.4 × 2.8–3.4 mm, little shorter than inner, acute or acuminate with apex spreading, outside without ridge and densely scaly with marginal scales ± unilaterally enlarged, inside ciliate-scaly on upper half; *inner calyx lobes* (3) oblong-obovate, 4.2–5.3 × 3.4–4.4 mm, rounded and with membranous margins, outside densely scaly and without fascicled cilia, inside glabous. *Petals* obovate, 8.4–12.2 mm long, bilobed. *Stamens* 28–35 (without staminodes), subequal, in bundles around ovaries; *filaments* strap-like, 0.9–1.6 mm long, scarcely basally connate; *anthers* narrowly obloid, 1.2–1.35 mm long, with truncate apex and tapering into filaments. *Pistils* 2; *ovaries* obovoid to almost spherical, each with 2 basal ovules, densely scaly, with style attached to apex from where it is curved back- and upward and then again forward to place constricted stigmas well above the apex of the anthers. *Fruiting peduncle* scarcely elongating, recurved. *Seeds* obovoid to almost spherical, 2.2–2.4 × 2.05–2.3 mm, black or brown; aril with fleshy attachment extending into a sheath (scarcely lobed) covering the lower third of the seed. *Flowering*: March–September. **Fig. 18D, E**.

Distribution and ecology. Growing on shallow soil on top of or among sandstone outcrops in *Thryptomene* shrubland or *Corymbia arnhemica* open woodland of northern Arnhem Land, Northern Territory (A).

Conservation status. Rare.

Diagnostic features. H. incurvata is superficially similar to *H. lepidota*, but differs by its elliptic-lanceolate leaves with irregularly incurved margins and very dense and partially overlapping scales on the upper leaf surface, which are of more or less equal size. The tufts of hairs on the terminal vein-end are usually more pronounced than in *H. lepidota*. Equally, it resembles small-leaved plants of *H. argyrochiton* but is distinguished by its more rigid-woody erect to spreading shrubby habit and smaller leaves. While *H. argyrochiton* has normally flat leaves, which seem to become progressively more incurved when dried, the leaves of *H. incurvata* are always more or less incurved, especially below the apex, and they become more and more rolled with dessication as is well illustrated in the specimen *K.G.Brennan 5746*.

Variation. Little is known about the variation of the species, as it has been recorded only a few times. Although the leaves are usually lanceolate, they often appear linear, because they are more or less incurved to rolled and about 1 mm broad, i.e. similar to those *H. lepidota*.

A specimen from Astell Island (*K.G.Brennan 3297*) has a vestiture of mainly rosette-like broad-based fascicled hairs and has been included in the species as it agrees in all other respects. The coarse appressed fascicled hairs of this plant must not be confused with the softly hairy, scarcely broad-based hairs found on the sometimes superficially similar leaves of *H. oblongata* subsp. *brevifolia*, a similar low growing shrub.

Etymology. The epithet "incurvata", Latin, refers to the "incurved" leaves, which are a particularly well developed feature of this species although occurring in most species of the *H. lepidota* subgroup.

Specimens examined

NORTHERN TERRITORY: *K.G.Brennan 3297*, Astell Island, 2.ix.1996 (DNA); *K.G.Brennan 5746*, N Gudjekbinj Station, 30.viii.2002 (DNA); *K.G.Brennan 8996*, ca 62 km SSW Maningrida, 18.iii.2000 (DNA); *I.D.Cowie 5613 & K.G.Brennan*, upper catchment of Magela Creek, 11.vi.1995 (AD, BRI, DNA).

52. *Hibbertia pancerea* Toelken, *sp. nov.*

Hibbertiae argyrochiton *similis sed habitu fructicoso, floribus majoribus et antheris longioribus; a* H. incurvata *floribus majoribus, antheris longioribus foliisque majoribus et planis differt.*

Typus: Northern Territory: Lightning Dreaming, *D.L.Jones 1465*, 22.ii.1984 (holo.: DNA; iso.: CANB).

Hibbertia sp. fire plot 121 (*K.G.Brennan 3821*): Northern Territory website: NTChecklist Jan 03.

Shrubs up to 1.5 m tall, spreading; branches ± angular to ridged from centre of leaf base, densely ciliate-scaly. *Vestiture* persistent, very dense, with larger over smaller mainly broad-rimmed ciliate-peltate and/or peltate scales on leaves, bracts and calyx; *on branches* dense, with larger and usually distinctly ciliate-peltate scales over smaller and often less markedly ciliolate-peltate scales; *on leaves above* dense, with larger rarely ciliolate-peltate scales over smaller normally entire ones, scarcely overtopping margins; *on leaves below* very dense, with scattered larger and normally distinctly ciliate-peltate scales overlapping smaller, overtopping margins with some ± unilaterally enlarged ones; *on bracts* above and below dense, similar to leaves except cilia mainly from unilaterally enlarged ciliate-peltate scales overtopping the margins below; *on outer* and *inner calyx* outside very dense, with larger over smaller ± ciliolate-peltate scales and on the outer ones unilaterally enlarged ciliate scales, inside ciliate scales distally on outer ones and glabrous on inner. *Leaves* without axillary tuft of hairs; *petiole* 0.6–1.2 mm long, distinctly grooved above; *lamina* elliptic to broadly elliptic, (7.8–) 15–25 (–31.2) × (6.3–) 10–15 (–18.7) mm, with rounded scaly apex, abruptly constricted into the petiole, flat, entire, above scarcely grooved along central vein, densely scaly with broad scales slightly overlapping, below with central vein slightly raised and more densely scaly with broad scales ±overlapping and/or with scattered larger ciliate-peltate scales overtopping others, with unilaterally extended cilia overtopping leaf margins, discolourous; juvenile leaves not seen. *Flowers* 1, "axillary", with rudimentary leaves at base of peduncle to terminal and becoming leaf-opposed on main shoots, with buds ellipsoid-obovoid; *peduncle* robust, 6–11 mm long, somewhat flattened; *bracts* lanceolate, 5.5–7.1 × 2.0–

2.3 mm, about half to as long as the outer calyx lobes, acute to pointed and often folded lengthwise in upper third (but without visible ridge) and ± spreading, above and below densely scaly overtopped by scattered ciliate-peltate scales particularly unilaterally enlarged ones along the margins. *Calyx* with lobes unequal; *outer calyx lobes* (2) elliptic-lanceolate, 7.3–8 × 3.5–4.3 mm, acute and often folded lengthwise in upper third but without visible ridge, outside densely scaly with some ciliate-peltate scales and mainly unilaterally enlarged ones but also fascicled cilia on the margins, inside densely peltate on upper half; *inner calyx lobes* (3) oblong to oblong-obovate, 5.1–5.8 × 4.1–4.9 mm, rounded and with membranous margins with or without fascicled cilia, outside densely scaly, inside glabrous. *Petals* broadly obovate, 14–16 mm long, deeply bilobed. *Stamens* 26–30 (without staminodes), subequal, in bundles around ovaries; *filaments* filiform, 1.1–1.5 mm long, scarcely connate basally; *anthers* narrowly obloid, 2.3–2.5 mm long, ± tapering into apex and filament. *Pistils* 2; *ovaries* broadly obovoid to almost spherical, each with 2 basal ovules, densely scaly, with slender style attached to outer apex from where it curved up- and slightly forward to place constricted stigma well above the apex of anthers. *Fruiting peduncle* scarcely elongating. *Seed* not seen. *Flowering*: February, March. **Figs. 1J, 2D & 18K–N**.

Distribution and ecology. Growing among sandstone rocks in shrubland to open forest on top of the escarpment of the northern Arnhem Land Plateau where it is locally known from near Lightning Dreaming, Kakadu National Park, Northern Territory (A).

Conservation status: Rare.

Diagnostic features. The species is superficially similar to *H. argyrochiton* because the plants are also densely covered by ciliate-peltate scales, but *H. pancerea* is distinguished by its shrubby habit to 1 m, the broadly elliptic leaves with rounded apex, and in particular by larger flowers with petals 14–16 mm long and aFnthers 2.3–2.5mm long. *H. incurvata* bears similar scales, but differs by its smaller flowers, shorter anthers, and incurved leaves rather than flat ones of this species.

Etymology. The epithet "pancerea", Medieval Latin for "with medieval mail of armour" (noun in apposition, ablative sing.) originally mainly used to protect the stomach, refers to the large peltate scales densely covering the whole plant, reminiscent of the overlapping platelets found on a medieval mail of armour.

Specimens examined

NORTHERN TERRITORY: *K.G.Brennan 3821*, Fire Plot 121, 24.iii.1999 (DNA).

3. Species insufficiently known

H. ?*scabra auct. non* R.Br. ex Benth.: A.S.George & Kenneally, Wild. Res. Bull. West. Austr. 6: 53 (1977), pro parte excl. *A.S.George 14102.*

The longer and broader leaves with ciliate-peltate scales on the undersurface and mainly large fascicled hairs above suggest *H. ciliolata* rather than *H. lepidota* for *A.S.George 14102* (Gariyeli Creek, lower Prince Regent River, Western Australia). This would be the only record of that species from Western Australia, but a definite identification can not be provided as no flowers are present on the specimen. As the habit is being given as "openly branched shrub 2 m", which is much larger than the local species, *H. lepidota* or *H. brevipedunculata*, this could indicate another new species to form with *H. ciliolata* possibly a vicarious pair similar to *H. complanata* and *H. fractiflexa* from similar localities. A particularly broad-leaved form of *H. lepidota* (*K.F.Kenneally 4160*) also from the Drysdale River National Park cannot account for the above variation as it has only scales on all surfaces of the leaves.

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